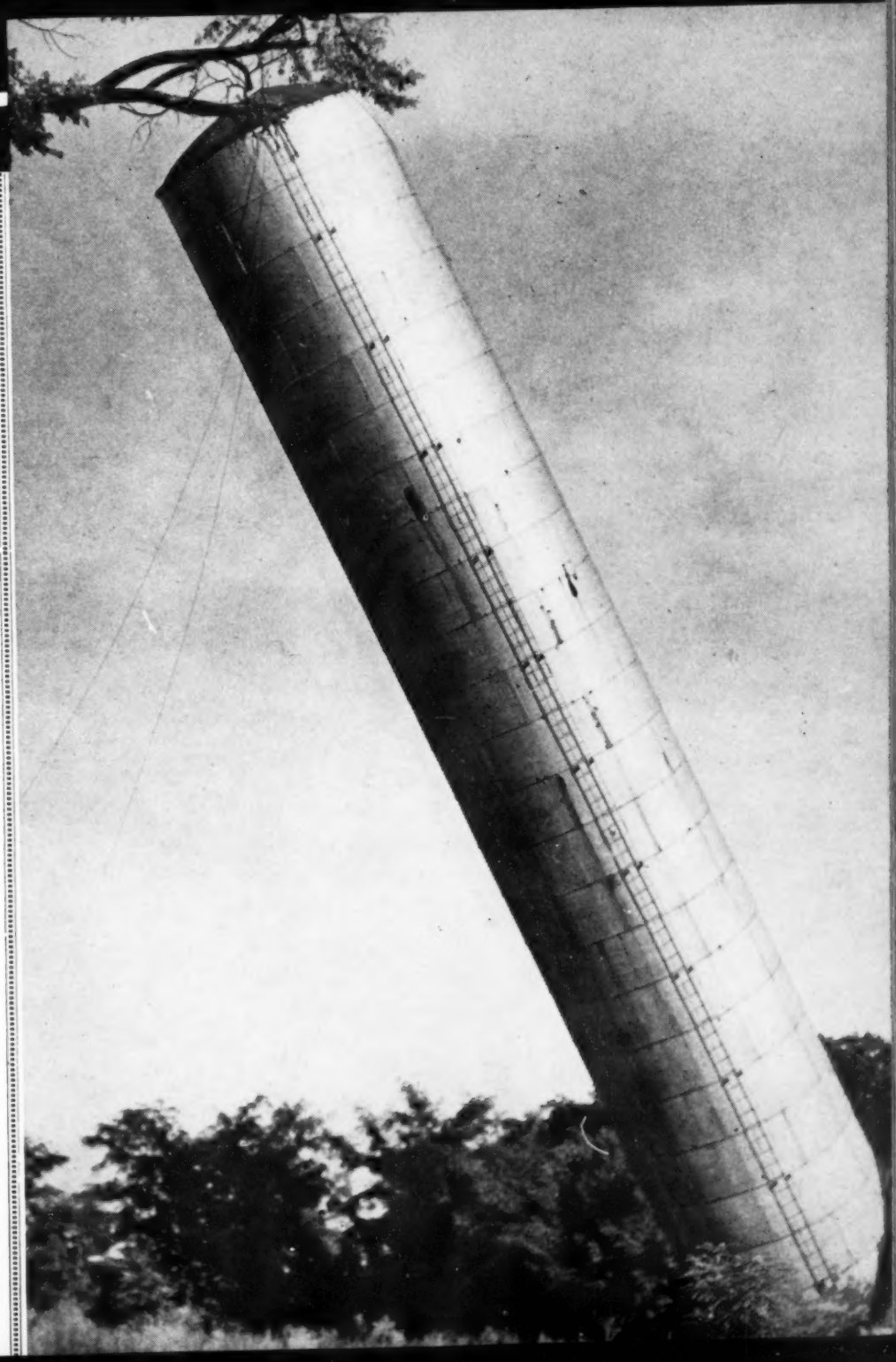
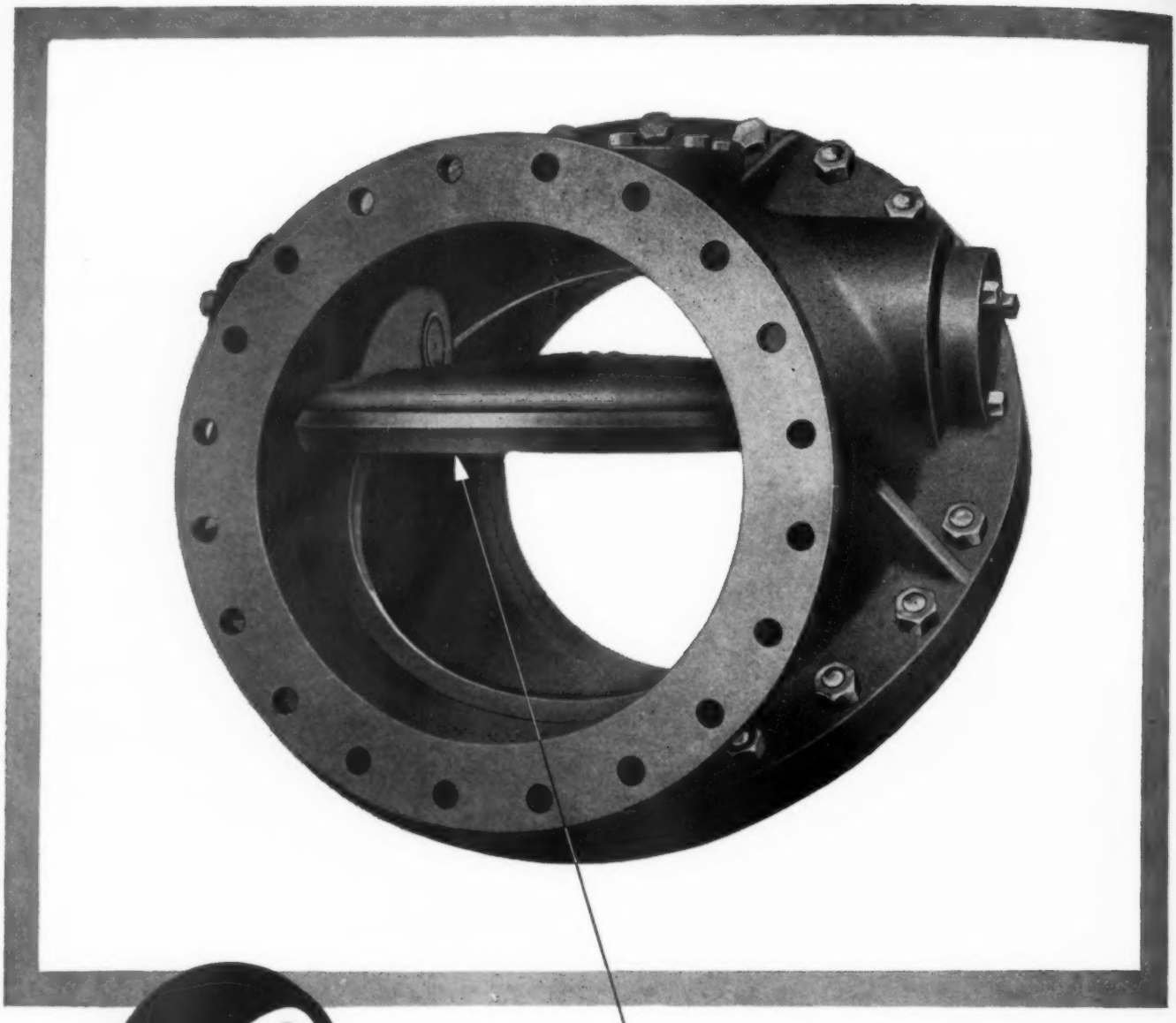
WATER & SEWAGE WORKS



TIMBER!

(Story in this Issue)



pipe line surging with the cushioned closing of

CHAPMAN

CHECK TILTING DISC VALVES

Cushioned by the effect of the stream on the short flap of the balanced disc, Chapman Tilting Disc Check Valves close smoothly and quietly. Slamming and dangerous pipe line stresses are eliminated . . . maintenance costs reduced. Head losses are cut 65% to 80% as compared with conventional type check valves.

Chapman Tilting Disc Check Valves are obtainable in either iron or steel. For complete information send for catalog No. 30.

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. June, 1949. Volume 96. Number 6. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c; Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second-class matter March 4, 1948, at the post office at Mount Morris, Illinois, under the Act of March 3, 1879.
Executive and business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N. Y.

PITTSBURGH-EMPIRE

large capacity meters

RIGHT for the job—RIGHT on the job

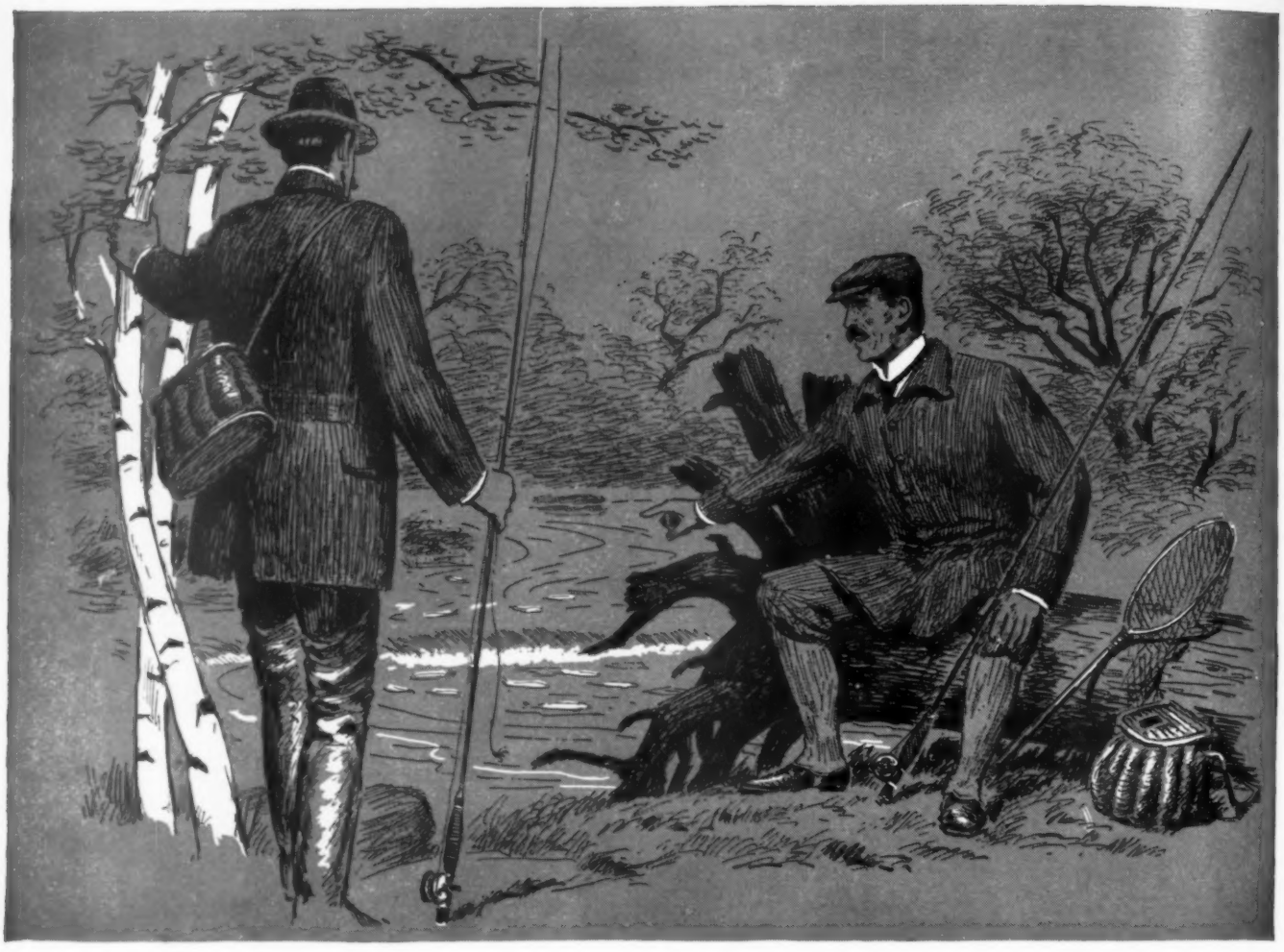
Commercial, industrial and apartment house services are potentially big revenue earners. To get all this revenue you need the right type of meter on every job. Fitting the proper meter to the setting is an important part of Pittsburgh-Empire service. We alone make all types of water meters, thus we can give you our recommendations without prejudice and in your best interests. To get all the facts on how to collect all your revenue, write the nearest District Office.

PITTSBURGH EQUITABLE METER DIVISION

ROCKWELL MANUFACTURING COMPANY

Pittsburgh 8, Pa.

Atlanta · Boston · Chicago · Houston · Kansas City · Los Angeles · New York · Pittsburgh · San Francisco · Seattle · Tulsa



"Look at those trout belly-up, Joe that means big trouble!"

Sanitary engineering has achieved notable progress in stream pollution control during the past half-century. Sewage treatment was introduced in 1899, the year our Company was organized. Today, more than 6,000 sewage treatment plants serve over half of our urban population. And substantial progress is being made in decontaminating industrial wastes discharged into streams and other waters.

Water supply and gas service have also made notable contributions to better health and living in the past 50 years. Today, more than 12,000 public water supply systems serve 85 million people with safe and palatable water. More than 20 million families are furnished with gas for cooking and heating.

After 50 years of manufacturing cast iron pressure pipe primarily and principally for water, gas and sewerage service, we too can point to a record of progress. In pioneering new and better production methods, such as the centrifugal process of casting—in improved quality controls—and in facilities for research and development. Cast iron pressure pipe as produced today in our several foundries bears witness to that progress—in terms of strength, toughness and uniformity.

To those responsible for the great progress in water supply, gas and sanitation service and their contribution to better health and living over the past fifty years, America pays tribute.

U.S. CAST IRON PIPE

1899-1949
U. S. Pipe & Foundry Co.
Makers for 50 years of cast iron pipe for water, gas and sewerage service.
General Offices: Burlington, N. J.

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING

Chemistry of Water Treatment

Is of particular interest to water purification engineers and chemists, but this series of papers on coagulation and water softening will be read with profit by any person in the field of water supply. These fundamental articles, the first four of which have already appeared, are the contribution of—

DR. A. P. BLACK,
Head, Chem. Dept., Univ. of Florida.
(President A.W.W.A.)

Eradicating Sewage Flies

Sets forth experiences in the use of D.D.T. for eradication of Psychoda and other fly breeding around the Joint Disposal Plant of the Los Angeles County Sanitation Districts, and describes step-by-step procedure which can be applied at plants of any size. The author is Editorial Associate—

A. M. RAWN, Chief Engr.,
Los Angeles County Sanitation Districts.

Emergency Procedures and Equipment

Is a topic always of interest and value to water works operators. This well illustrated article is another by an author well known for his previous practical contributions—

SHERMAN ROGERS, Distrib. Supt.,
Water Bureau, Hartford, Conn.

Determination of First-Stage B.O.D.

By means of a chemical oxygen demand test is becoming a nearer possibility, according to the results of this study, which reports a continuation of the work originally published in this magazine in May, 1947, by—

GEORGE A. RHAME, San. Engr.,
Fort Jackson, So. Car.

Corrosion Control

One of the most effective and practical papers that we have ever heard presented has never been put into form for publication. The author has promised us his discussion, based on a variety of experiences in corrosion control in connection with U. S. Army Camps. This contribution comes from—

DAN. PRODANOVICH, Eng'r.,
East Bay Utilities Distr., Oakland, Calif.

Metallurgical Plant Wastes and Their Treatment

Is a topic receiving increasing attention of sanitary and industrial engineers. This article presents an approach to and the solution of such problems. The author is—

HARRY D. UNWIN, Engr.,
Albert Kahn Associates, Detroit, Mich.

Preconditioning and Digestion of Sewage Sludge

Is being discussed in a series of articles by a well qualified author with considerable plant operating experience. The 3rd in the series will appear next month. The contributor, already known to our older readers, is—

T. R. HASELTINE, Partner,
The Chester Engrs., Pittsburgh, Pa.

Operation of Small Water Plants

Is the general title of a new series of articles by the same author whose series on the "Operation of Small Filtration Plants" we published during the past year. The next article of the new series discusses "Meters & Metering"; the third "Billing & Collections." The author is—

A. E. CLARK, Gen'l Mgr.,
Nashville (Tenn.) Suburban Utility Dist.

Combined Water & Sewage Plant Operation in a Small Town

Is the story of the development of a water softening plant and a sewage treatment plant under a self liquidation plan. The recounting of the operating and management problems that ensued from joint management of the utilities is presented as told to our Associate Editor by—

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Sullivan, Ill.

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A. M. RAWN

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H. P. GILLETTE, Pres.; E. S. GILLETTE, Vice Pres.; L. H. ENSLOW, Vice Pres.

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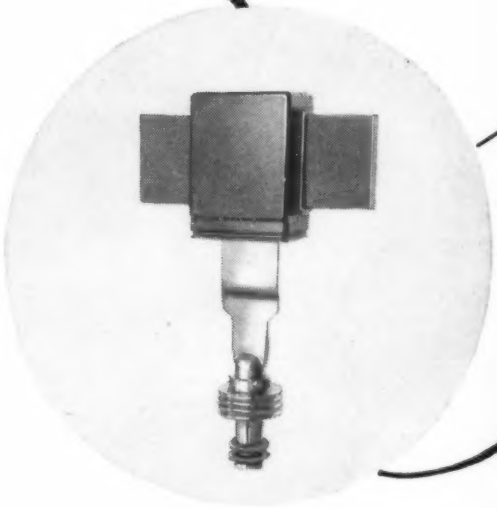
all these devices

co-ordinated

in one functional package

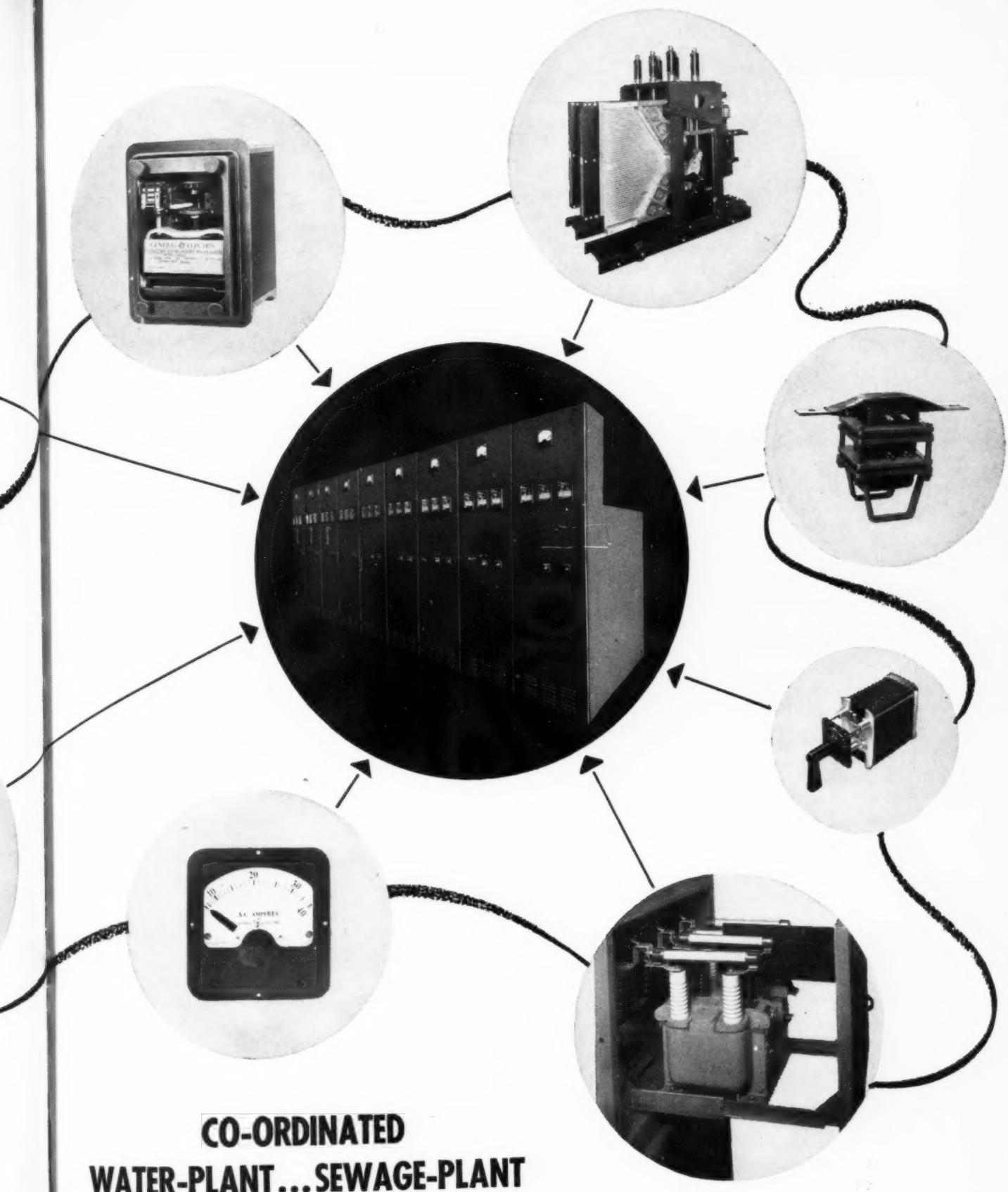
G-E metal-enclosed switchgear designed, factory-assembled and tested to solve all your protection, metering and relaying problems

A simple, one-line diagram is all the information our water and sewage engineers need to go to work on your power-distribution problem in new or expanding plants. From this diagram they can help you plan your distribution system and the necessary switchgear control and protective equipments to provide efficient flow of power to your load areas. These equipments will include circuit breakers of adequate interrupting capacity, relay protection, instrumentation and other associated devices, assembled and interconnected within streamline metal enclosures.



More Information?

Your consulting engineer or General Electric representative will tell you more about these equipments and help you plan your entire electrical layout. Consult him early, so that you can profit by co-ordinated planning and thereby simplify engineering, construction and installation. *Apparatus Dept., General Electric Company, Schenectady, N. Y.*



CO-ORDINATED
WATER-PLANT...SEWAGE-PLANT
ELECTRIFICATION

GENERAL ELECTRIC

666-54

Bulletin on POROUS MEDIA

by CARBORUNDUM

TRADE MARK

NO. 3 JUNE, 1949

Meeting Requirements of Successful Air Diffusion

Recent experiences at many activated sludge plants have pointed to a cogent fact: *that ceramically bonded-porous diffusers of the ALOXITE aluminum oxide type continue to prove their ability to meet the peculiar and difficult requisites of the process!* This is vital when considering the further fact that air diffusers comprise the single most important equipment or design factor affecting overall efficiency.

Even when the process was introduced 25 years ago, it became apparent that there were two opposing diffuser requirements:

1. Small pore material to discharge minimum size air bubbles for maximum oxygen absorption while simultaneously performing the major function of mechanical air lift;
2. Sufficiently large pores to avoid early clogging from either air side or liquor side.

An adequate balance between these conflicting points was originally established with porous ceramic media. Improvement in this balance has been steady throughout the period of use because pore size and other product characteristics are controllable. *In the past many other materials and equipment ideas were tried but have proved inadequate.*

ALOXITE diffuser plates and tubes meet the further important requirements of uniformity and freedom from corrosion, erosion or strength deterioration. Because they are time-tested and proved in meeting *all* requirements and specifications, they are now the ideal media for successful aeration.

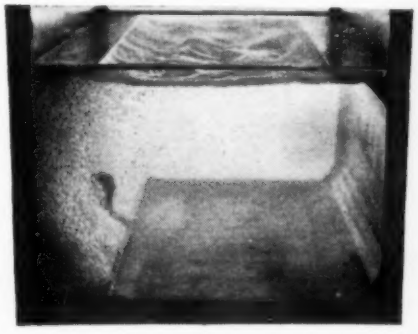
Properties of ALOXITE Porous Media

MATERIAL	Ceramically bonded crystalline aluminum oxide grain of controlled sizes.
GRADES (Pore size)	**Filter Underdrains**... coarse and very coarse. **Direct Filtration**... range from very fine to medium. **Diatomite Support**... range from fine to medium. **Air (gas) Diffusion**... range from fine to coarse (permeability from 10 to 120.)
SOLUBILITY	**In Water and Air**... insoluble at all normal operating temperatures. **In Acids**... generally resistant at all operating temperatures, except to hydrofluoric acid. **In Alkaline Solutions**... ceramic bonds are progressively soluble with time and temperature increases.
STRENGTH	Transverse breaking strength is relatively good ranging from 1000 lbs./sq. in. (coarse grades) to 3000 lbs./sq. in. (fine grades).
REFRACTORINESS	All grades withstand up to 900° C. without softening.
THERMAL SHOCK RESISTANCE	Withstand changes up to 20° C./hr. (Where more severe heat shock exists, ceramically bonded silicon carbide porous media are available.)
POROSITY	Ratio of pore volume to total volume of all grades approximately 35%.
WEIGHT	Approximately 0.09 lbs./cu. in.

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

ALOXITE Diffuser Bubbles...

- There are more installations of ALOXITE diffusers in service than of any other make.
- ALOXITE diffusers are used in the first activated sludge plant in the United States, located at San Marcos, Texas, where they replaced perforated pipe.
- When diffusers are selected for new process or equipment, the choice is invariably ALOXITE plates or tubes.



- ALOXITE diffuser plates and tubes are available from stock in a variety of shapes, sizes and grades.

TECHNICAL DATA

on porous media and their application

is available on request. You may obtain any or all of the following engineering bulletins by writing Dept. A-69.

No. 1—Aeration of Sewage and Water.

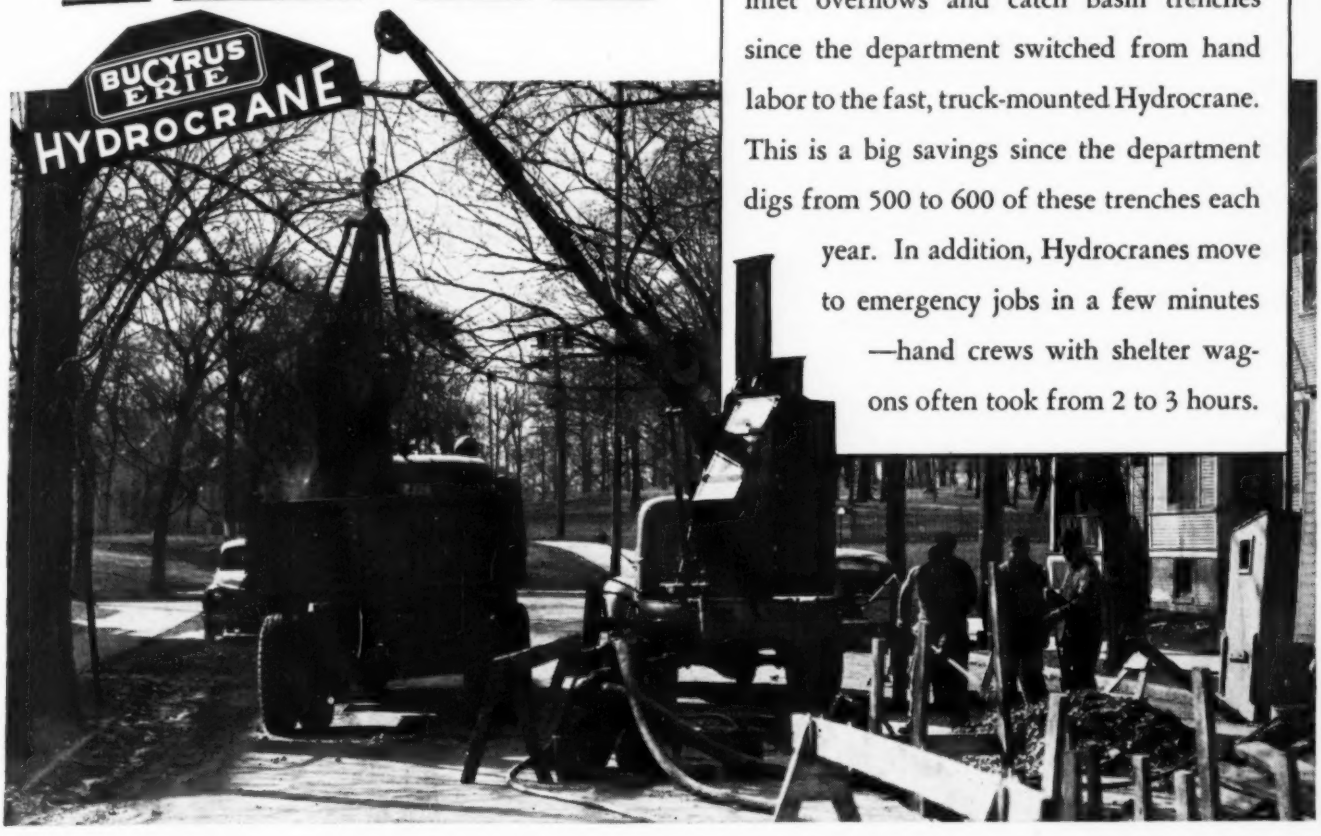
No. 2—Underdain Systems for Filters and Softeners.

No. 3—General Catalog information.

THE CARBORUNDUM COMPANY
Refractories Division
PERTH AMBOY, NEW JERSEY

Milwaukee Sewer Department Cuts Trenching Costs 30%

Milwaukee Sewer Department records show a reduction of 30% in cost of digging storm inlet overflows and catch basin trenches since the department switched from hand labor to the fast, truck-mounted Hydrocrane. This is a big savings since the department digs from 500 to 600 of these trenches each year. In addition, Hydrocranes move to emergency jobs in a few minutes —hand crews with shelter wagons often took from 2 to 3 hours.



The Bucyrus-Erie Hydrocrane handles many jobs no other crane can touch — travels up to 50 m.p.h. on the open road . . . works in close quarters . . . simple to operate, hand levers only . . . precision control for close work. Two models — ¼ yd. 2-ton H-2 and ⅜ yd. 3-ton H-3. Send for complete information today.

Equipped with a special hydraulic catch basin bucket, this Hydrocrane makes quick work of cleaning clogged catch basins.

Here are some of the jobs handled by the fully hydraulic Hydrocrane:

With a hydraulic bucket it . . .

Digs storm inlet overflows and catch basin trenches.
Digs lengths of trenches for sewers that have broken down.
Loads dirt into trailers.
Back-fills crushed stone around pipe.
Handles clean-up work.

With a hook and chain it . . .

Sets sewer pipe.
Places valve and pipe fittings on water mains.

BUCYRUS ERIE

HYDROCRANE DIVISION SOUTH MILWAUKEE, WIS.

37H49

BUCYRUS-ERIE HYDROCRANE DIVISION, South Milwaukee, Wisconsin

Gentlemen: I want the full story on the Hydrocrane.

Name.....

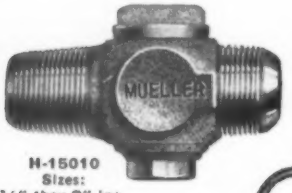
Dept. or Company.....

Address.....

City.....(.....) State.....

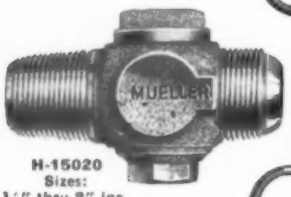
H-15000
Sizes:
¾" thru 2" inc.

Inlet—MUELLER Thread
Outlet — For Copper Service Pipe with Straight Coupling Nut. (Gasket Not Required.)



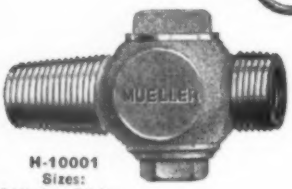
H-15010
Sizes:
¾" thru 2" inc.

Inlet—MUELLER Thread
Outlet — For Copper Service Pipe with ⅛ Bend Coupling and Gasket.

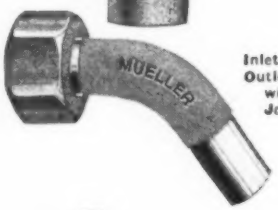


H-15020
Sizes:
¾" thru 2" inc.

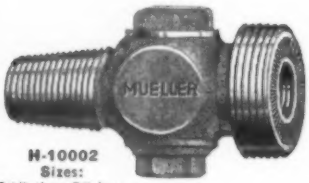
Inlet—MUELLER Thread
Outlet — For Copper Service Pipe with ¼ Bend Coupling and Gasket.



H-10001
Sizes:
¾" thru 2" inc.

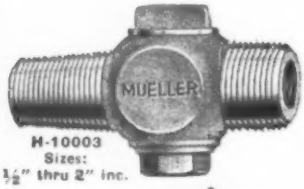


Inlet—MUELLER Thread
Outlet — Mueller Thread with ⅛ Bend Wiped Joint Coupling.



H-10002
Sizes:
¾" thru 2" inc.

Inlet—MUELLER Thread
Outlet — Lead Flange Coupling.



H-10003
Sizes:
¾" thru 2" inc.

Inlet—MUELLER Thread
Outlet—Iron Pipe Thread One Size Larger Than Body. Without Coupling.

MUELLER Corporation Stops have many features of design and construction which result in TROUBLE-FREE installation and service.

- Every part cast from high copper content bronze for maximum resistance to corrosion.
- Ruggedly designed to prevent distortion during manufacture, handling, installation and service. Results in a water-tight stop.
- Precision made ground key construction with each key and body ground and lapped together.
- MUELLER inlet threads are accurately machined to meet exacting specifications, assuring a water-tight joint at the main.
- Outlet connections are individually designed for the type of service to be used, resulting in the least number of joints.

For a dependable connection to the main, easily made without interruption of service, use MUELLER Corporation Stops* installed with a MUELLER Tapping Machine equipped with a MUELLER Combined Drill and Tap.*

**Consistently Produced With Accurately Matched Threads.*

MUELLER CO.

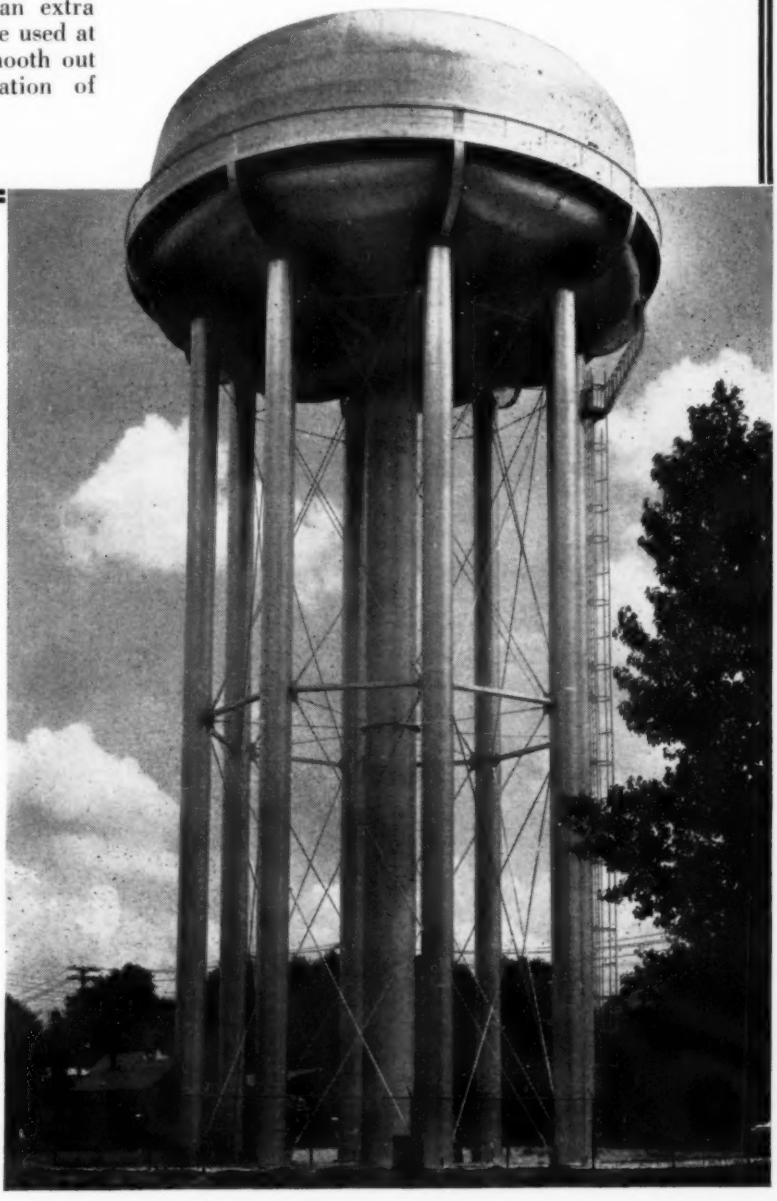
MAIN OFFICE AND FACTORY.....DECATUR, ILLINOIS
OTHER FACTORIES: *Los Angeles, Cal.; Chattanooga, Tenn.; Sarnia, Ont. Canada*

HORTON *Elevated Tanks*

provide more uniform water pressure

IN cities where increased customer demand has made the existing water systems inadequate and uneconomical to operate, Horton elevated tanks offer a simple and effective means of bringing them up to date. By holding a reserve supply of water, elevated storage offers an extra margin of gravity pressure which can be used at any time to meet peak loads and to smooth out pressure variations. Also, the operation of pumping equipment can be spread out into off-peak periods when power rates are lowest.

A Horton elevated tank will, in effect, increase the capacity of existing water facilities.



Advantages of welded construction

The butt-welded joints of Horton steel tanks are watertight. There are no rivets used, no caulking, and there is no leakage from the seams. Welded construction makes it possible to keep corrosion at a minimum by eliminating sharp edges and inaccessible corners or crevices where dirt might collect. Maintenance is simplified because all points are accessible for inspection and painting. Horton welded tanks are graceful structures, with smooth, curved surfaces and simple details.

At the right is a 500,000-gal. Horton radial-cone-bottom elevated tank at Bucyrus, Ohio. This design is used in Horton tanks with capacities from 500,000 and 2,500,000 gals. The Horton ellipsoidal-bottom design is used for tanks between 15,000 and 500,000. For full details on these tanks, write our nearest office.

CHICAGO BRIDGE & IRON COMPANY

Atlanta 3	2181 Healey Building	Detroit 26	1551 Lafayette Building	Philadelphia 3	1644–1700 Walnut Street Building
Birmingham 1	1586 North Fiftieth Street	Houston 2	2115 National Standard Building	Salt Lake City 1	1550 First Security Bank Building
Boston 10	1048–201 Devonshire Street	Havana	402 Abreu Building	San Francisco 11	1283–22 Battery Street Building
Chicago 4	2198 McCormick Building	Los Angeles 14	1555 General Petroleum Building	Seattle 1	1350 Henry Building
Cleveland 15	2262 Guildhall Building	New York 6	3390–165 Broadway Building	Tulsa 3	1646 Hunt Building

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Detroit

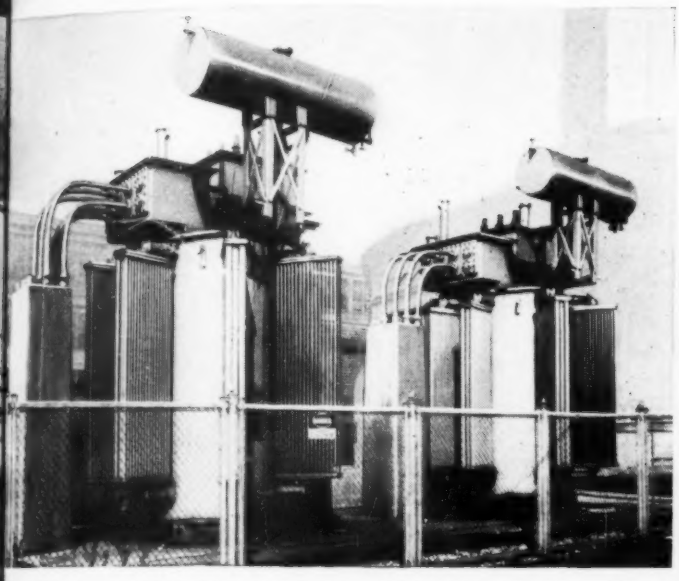
Thrifty Cities See *Dollars Go Further* With Reliable, Low Maintenance A-C Products

THAT'S WHY so many cities — large, medium and small — are using more and more Allis-Chalmers equipment today. Detroit's sewage pumping stations and disposal plants for years have used Allis-Chalmers synchronous motors and transformers. One water works pump station is equipped with a battery of A-C centrifugal pumping units.

Tax conscious cities, caught between lagging incomes and rising costs, are discovering that *budgets go further* with A-C equipment. A-C centrifugal pumps, for example, have met every efficiency rating guaranteed for them. Allis-Chalmers motors and turbines are designed to fit the specific pump for which they are built. Electric power needs are met with Allis-Chalmers power and distribution transformers . . . protected, controlled and regulated with A-C metal-clad switchgear and control devices.

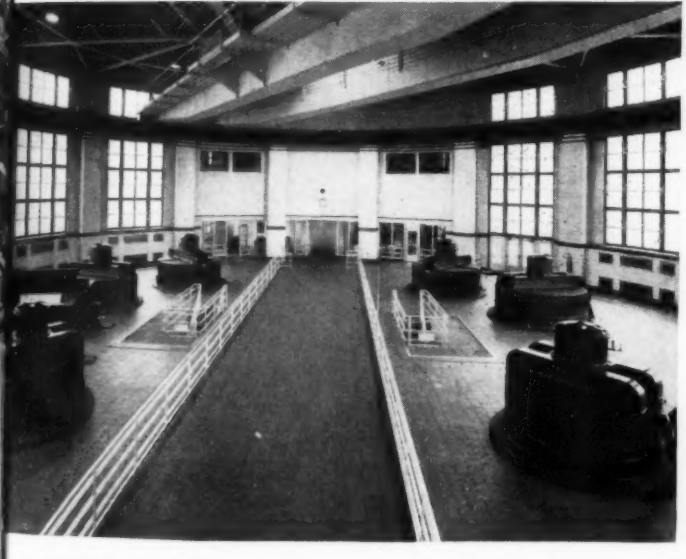
No other company offers coordinated equipment engineering for so many electrical and mechanical public works products. For more information on how *your* city can benefit from buying Allis-Chalmers equipment, we will send you a free copy of Bulletin 25B6607. *Write for it today.*

KNOWS DEPENDABLE MUNICIPAL EQUIPMENT!



THESE "Old Faithfuls" have given dependable service in Detroit's public works for many years. Today, new Allis-Chalmers transformers can be equipped with Load Ratio Control devices to provide close voltage regulation during the hours of peak load and low load pumping periods.

CIRCULAR shaped Detroit sewage disposal plant pump room is equipped with six Allis-Chalmers synchronous motors. Your community *can save money* by taking advantage of Allis-Chalmers experience in designing and building both electrical and mechanical public works equipment.



1250 HP synchronous motors drive sewage pumps in Jefferson Avenue sewage disposal plant. Allis-Chalmers has designed and manufactured all sizes and types of motors and turbines for driving centrifugal pumps for all sizes of communities all over the country.

ALLIS-CHALMERS, 1192A SO. 70 ST.
MILWAUKEE, WIS.

WELCOME A.W.W.A.

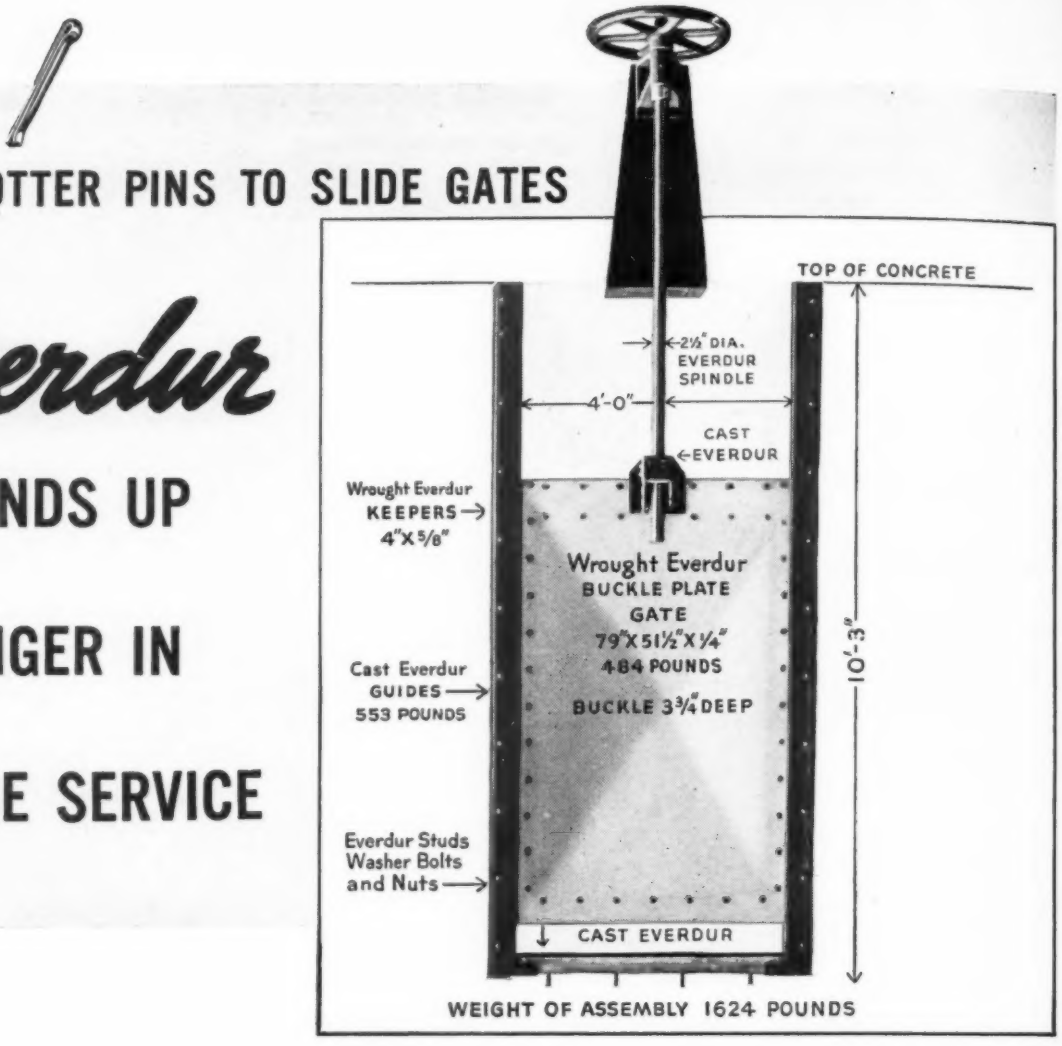
When your convention meets in Chicago, May 29 through June 3, Allis-Chalmers extends to each of you the wish that your stay will be both pleasant and profitable. We invite you to drop in and visit our exhibit in the Stevens Hotel. We'll be in booths 133, 134.

A 2695

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Builders of the World's Widest Range of Public Works Equipment



FROM COTTER PINS TO SLIDE GATES

Everdur

STANDS UP

LONGER IN

SEWAGE SERVICE

One of the five 13-year-old shut-off gates of Everdur Metal in the screen room of the Rahway Valley Joint Meeting Sewage Treatment Plant.

For 20 years Everdur* Copper-Silicon Alloys have performed well under the corrosive conditions imposed on sewage treatment equipment. These alloys have unusual resistance to corrosion. In addition, they provide high strength and, according to type, may be cast, hot or cold rolled, drawn, spun, forged or welded.

A good example of Everdur advantages is seen in the five shut-off gates in the screen room at Rahway, N. J., installed more than 13 years ago. These gates, which operate smoothly and easily by hand, weigh 1624 lbs., while cast, electrically-driven gates for the same service would have weighed well over four tons each!

In view of the fact that sewage service must not fail, a cotter pin may be as essential as the most massive equipment. Thus, Everdur Metal has been more and more widely specified for such uses as:

Coarse and Fine Screens
Swing Gates
Built-up Sluice Gates
Bar Rack Aprons
Effluent and Scum Weirs
Scum Baffle Brackets
Troughs
Screen Hoppers
Orifices
Backets
Anchors
Ladders
Float Gage Chains
Valve Springs
Manhole Steps
Guides
Walkways
Bars and Plates
Bolts and Nuts

For detailed information, write for Publications E-11 and E-5.

*Reg. U. S. Pat. Off.

47188

ANACONDA
from mine to consumer

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

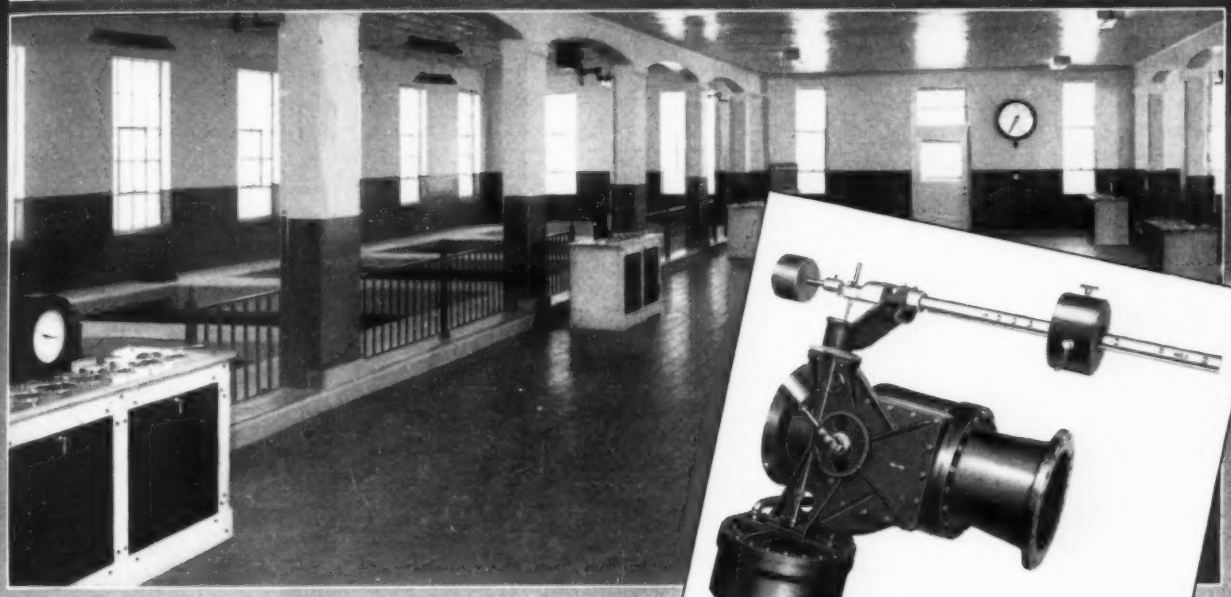
General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

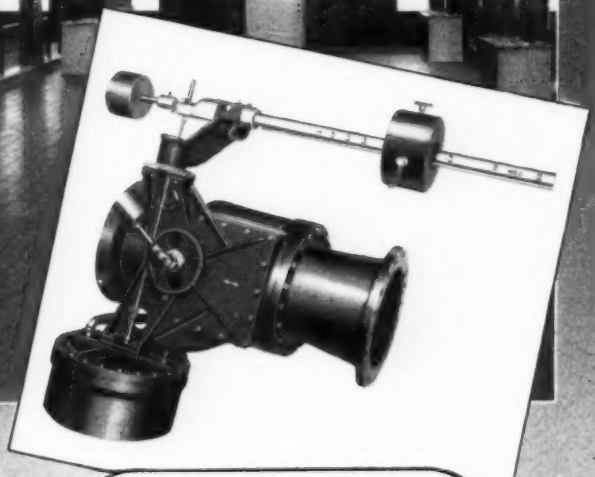
COLUMBUS, GA.

Columbus Water Works

(Completed in 1948)

WIEDEMAN & SINGLETON
Engineers





This modern addition to the Columbus Water Works, built under the direction of George R. Lowe, Jr., Gen. Mgr., and Nolan L. Dudley, Supt. of Filtration, supplies pure water to over 43,000 people in the county of Muscogee, Georgia. Builders Controllers, Gauges and other equipment were installed in the 1948 addition by the Standard Construction Company, duplicating Builders equipment installed in 1946 by Fiske Carter Construction Company. For Bulletins describing Builders water works equipment, address Builders-Providence, Inc., (Division of Builders Iron Foundry), Providence 1, R. I.

Builders-Providence equipment furnished for Columbus Water Works:

- **6—12" Model RCE Rate Controllers, each having a controlling range of 575,000 to 2,250,000 gallons per day**
- **6—Model GA8-I Loss of Head and Rate of Flow Indicating Gauges with Diaphragm Pendulum Units**
- **2—24" Illuminated Dial Chronoflo Indicators**
- **2—24" Venturi Tubes with Type M Registers**
- **1—24" Venturi Tube with Chronoflo Transmitter**
- **6048 sq. ft. Wheeler Filter Bottoms**

BUILDERS PROVIDENCE
Instruments

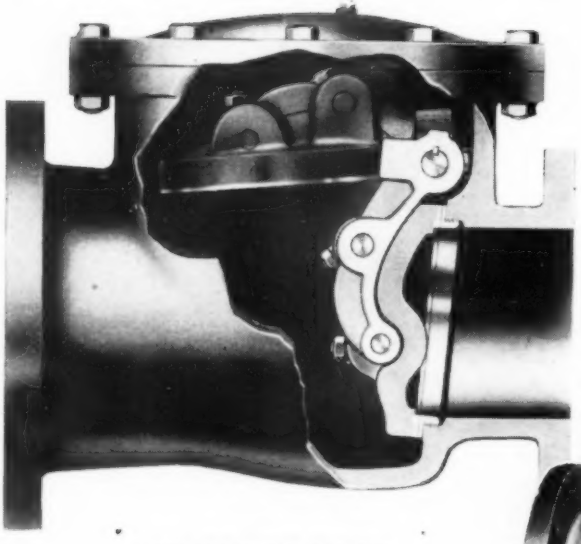
Seat without SLAM and seat TIGHT!

HEAVY STAINLESS STEEL MAIN HINGE SHAFT

HEAVY SOLID BRONZE GATE HINGE

STAINLESS STEEL KEY

DUAL STAINLESS STEEL GATE PINS

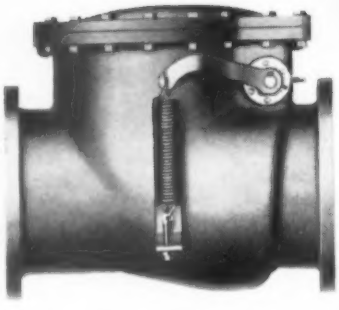


GATE ALWAYS TIGHT AGAINST INCLINED SEAT EVEN WITH SPRING REMOVED

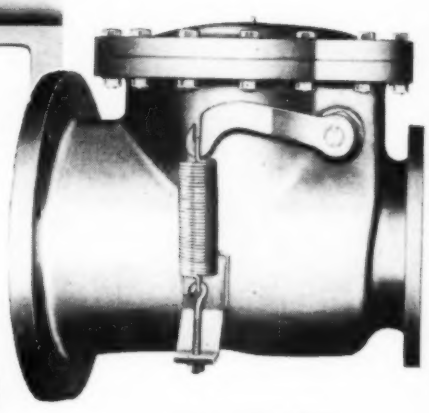
RUGGED CAST IRON BRONZE MOUNTED GATE

FULL CLEARWAY PASSAGE

OUTSIDE LEVER AND SPRING ADJUSTABLE TO INSURE QUIET CLOSING



STRAIGHT-THROUGH TYPE



INCREASING TYPE

RENSSELAER

CHECK VALVES

Wherever you want positive elimination of check valve SLAM on pump shut-down, low loss of head, and long valve life — use Rensselaer Check Valves. The adjustable spring tension positively seats the gate the moment the water column in the discharge line comes to rest.

Rensselaer Check Valves are made in both the "straight-through" and "increasing" type. The latter saves space by eliminating increasers.

Construction throughout is rugged, simple. Built of high tensile strength corrosion-resistant iron, stainless steel, durable bronze. Alemite fittings on sizes 16" and larger.

Send for a Rensselaer Representative for any problem concerning Valves, Hydrants or other Rensselaer products. His seasoned advice is yours, without obligation.

LEADERSHIP FOR OVER 65 YEARS

RENSSELAER

VALVES & HYDRANTS IN STOCK ATLANTA CHICAGO KANSAS CITY LOS ANGELES

Gate Valves • Square Bottom Valves • Tapping Valves and Sleeves
Hydrants • Check Valves • Air Release Valves

RENSSELAER VALVE COMPANY • TROY, N. Y.

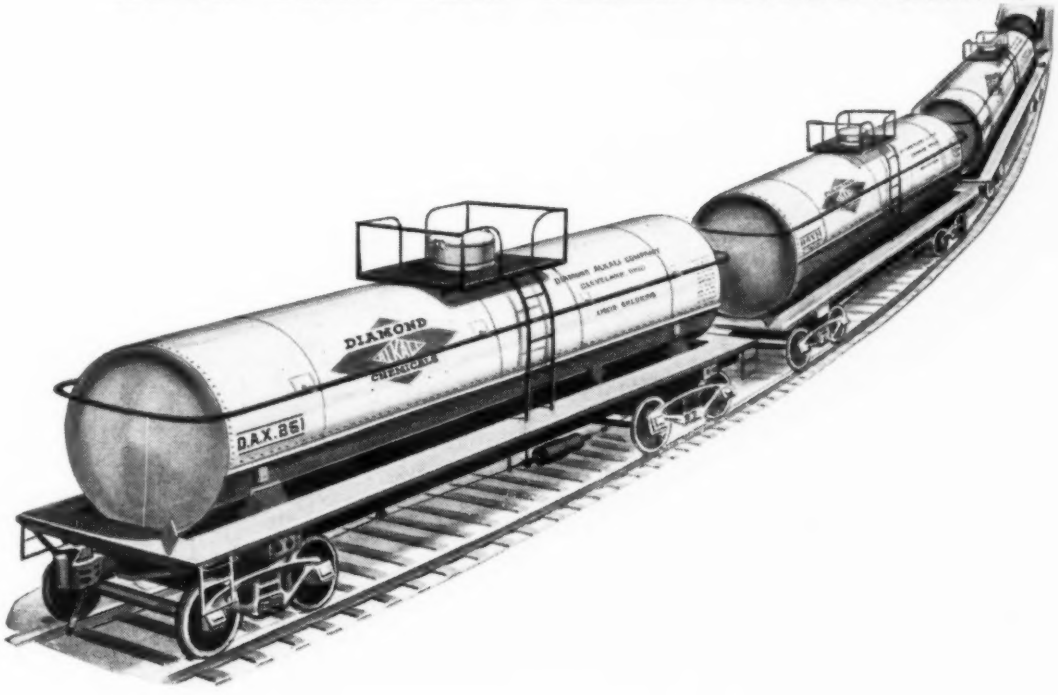
Division of Neptune Meter Company

Atlanta, Bala-Cynwyd, Pa., Chicago, Denver, Haverhill, Mass., Hornell, N. Y., Kansas City, Los Angeles, Memphis, Oklahoma City, Pittsburgh, San Francisco, Seattle, Waco

* CHLORINE * SODA ASH * ALKALI SPECIALTIES * SILICATES

Chemicals you live by

HOOK ONTO THIS WATER CONDITIONING LINE



Your chlorine needs for water purification can be even more speedily filled now. DIAMOND's new electrochemical plant at Houston is the fourth of its modern plants providing Liquid Chlorine. They are all strategically located for prompt service . . . Edgewood, Maryland; Painesville, Ohio; Pine Bluff, Arkansas and Houston, Texas.

The centrally located plant at Painesville also furnishes DIAMOND Soda Ash and Alkali Specialties for water softening and equipment protection. DIAMOND Standard Silicates for settling impurities and clarifying water, are produced in seven plants.

All in all, DIAMOND ALKALI provides a chain from coast to coast, for quick response to your needs.

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DIAMOND ALKALI COMPANY • CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS

Cylindrical Plug gives full volume pipe flow

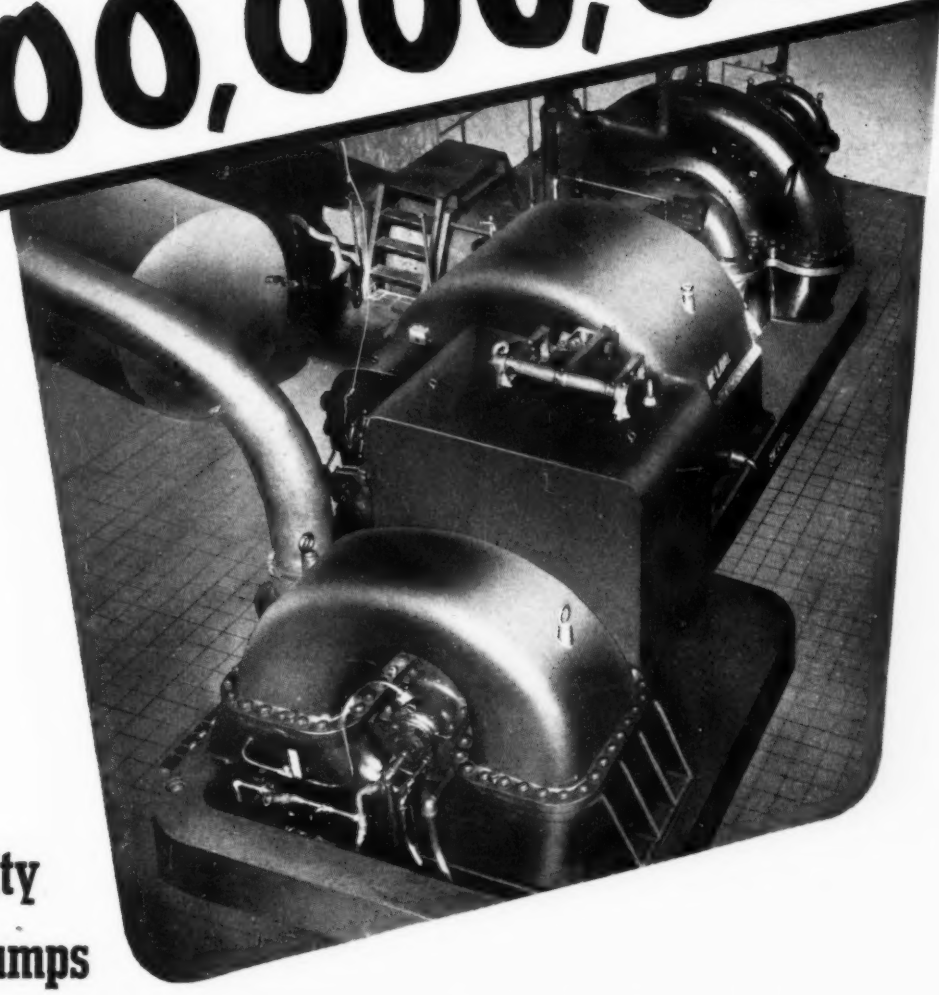
a.c.f. Cylindrical Plug Valves cut the man-waiting time of flow control in batch measuring. And on high volume flow, the exclusive straight-through, full pipe opening saves power. Any valve less efficient is more costly in the long run.

a.c.f. CYLINDRICAL FULL PIPE AREA LUBRICATED PLUG VALVES

Representatives in more than 50 principal cities.

A.C.F. Round-Port Valves are ideal for sludge lines. Write for Catalogue No. 3W—direct to American Car & Foundry Company, Valve Division, 30 Church Street, New York 8, N. Y.

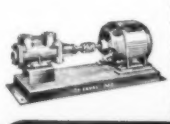
1,300,000,000



Total Capacity of De Laval Pumps in the City of Chicago . . . 1,300,000,000 Gallons Daily

In the year 1920, the City of Chicago installed its first turbine-driven centrifugal pump – a unit of 60 mgd capacity in the Central Park Station. The performance, trouble-free operation, economy and flexibility of this unit proved to be so satisfactory that additional De Laval turbine-driven pumps were installed in rapid succession.

Today, the City of Chicago is served by a total of 16 De Laval turbine-driven pumps and 5 De Laval motor-driven pumps having a total capacity of one billion, three hundred million gallons daily.



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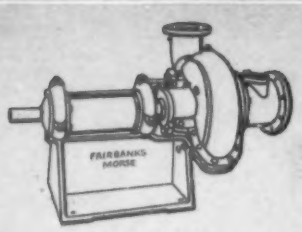
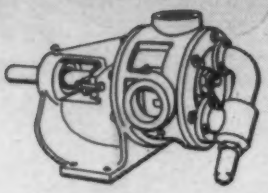
TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

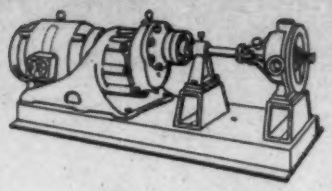
WW7



Paper Stock Pumps



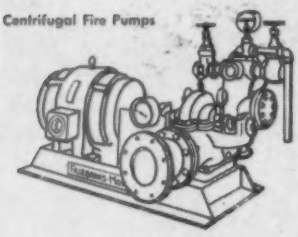
Frame Constructed Rotary Pumps

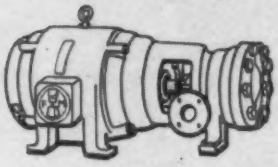


Rotary Pumps with Geared Head Motor Drive

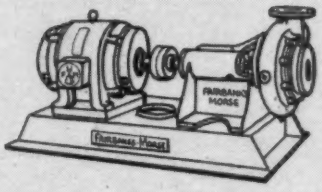
Vertical Propeller Pumps

Centrifugal Fire Pumps

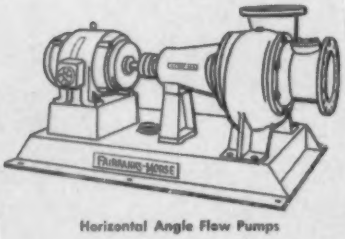




Two-Stage Builtogether Pumps



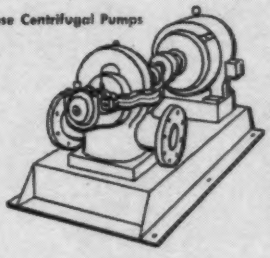
Horizontal Sewage and Trash Pumps

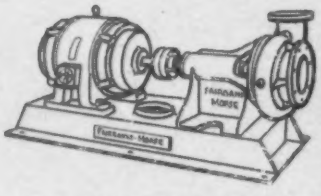


Horizontal Angle Flow Pumps

Vertical Close-Coupled Sewage and Trash Pumps

Split-Case Centrifugal Pumps

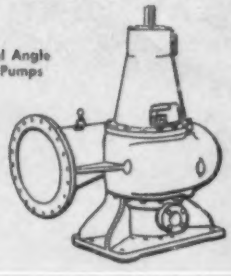


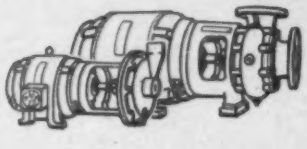


Base-Mounted Centrifugal Pumps

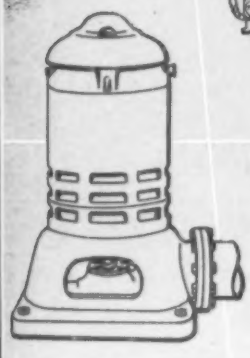
Vertical Sewage and Trash Pumps

Vertical Angle Flow Pumps

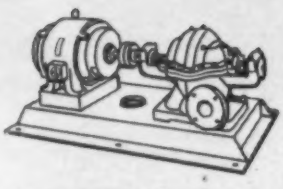




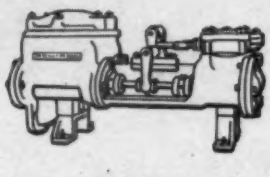
Builtogether Centrifugal Pumps



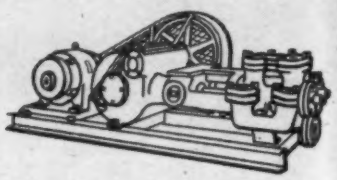
Deep Well Turbine Pumps



Two-Stage Centrifugal Pumps



Duplex Steam Pumps



8 Cover Side-Pot Duplex Power Pumps

for Pumps...

THAT DELIVER

plus performance
lasting dependability
unsurpassed economy

The Fairbanks-Morse Pump Dealer is your best bet for assistance in pump selection...for reliable service. Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES
MOTORS • GENERATORS • STOKERS • RAILROAD MOTOR CARS
and STANDPIPES • FARM EQUIPMENT • MAGNETOS

Less Infiltration

TRANSITE* SEWER PIPE offers two basic safeguards that minimize infiltration in sewer lines: *tighter* joints and *fewer* joints.

Transite's special sleeve-type joints make up tight and stay tight in service.
Its long 13-foot lengths reduce the number of joints in the system.

These safeguards cut down the volume usually allowed for infiltration, reducing sewage load on the treatment plant and conserving plant capacity for future needs. Where new treatment facilities are planned, this reduced infiltration may permit consideration of a smaller plant with resulting economies.

Other Transite Economies—Transite's long lengths help maintain uniform grades; fewer joints reduce turbulence in the line. These advantages, added to Transite's unusually smooth interior, mean better flow qualities (Kutter's n=.010). This often permits designing the system with flatter grades and shallower trenches. Or, as an alternate economy, pipe of smaller diameter may be specified.

Transite Sewer Pipe is made of asbestos, cement and silica by a special manufacturing process that employs steam curing to develop greater corrosion resistance and strength. It is available in four strength classes in sizes to 36", permitting selection of the pipe best suited to trench conditions, and frequently eliminating the need for concrete cradles.

For further details, write Johns-Manville, Box 290, New York 16, N. Y.

*Transite is a Johns-Manville registered trade mark

.....Johns-Manville

TRANSITE SEWER PIPE...

Everything in piping for pumping systems from one complete line . . . CRANE

Take This Sewage Station Pump Room, for example. Crane can supply every piping item for the entire system—valves, fittings, pipe and accessories. One order to Crane covers every piping equipment need, and assures dependable service. For Crane supplies you through a network of well-stocked cooperating Branches and Wholesalers, backed by large factory stocks.

The wider selection—and better service—given by this **Single Source of Supply** can simplify every piping procedure . . . specifying, ordering, erection and maintenance. Putting **Complete Responsibility** on Crane for materials helps you to get better installations, avoids needless delays. **One Standard of Quality** in every item helps assure more dependable performance from every part of your piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Nation-wide Service Through Branches and Wholesalers

ONE SOURCE OF SUPPLY
RESPONSIBILITY
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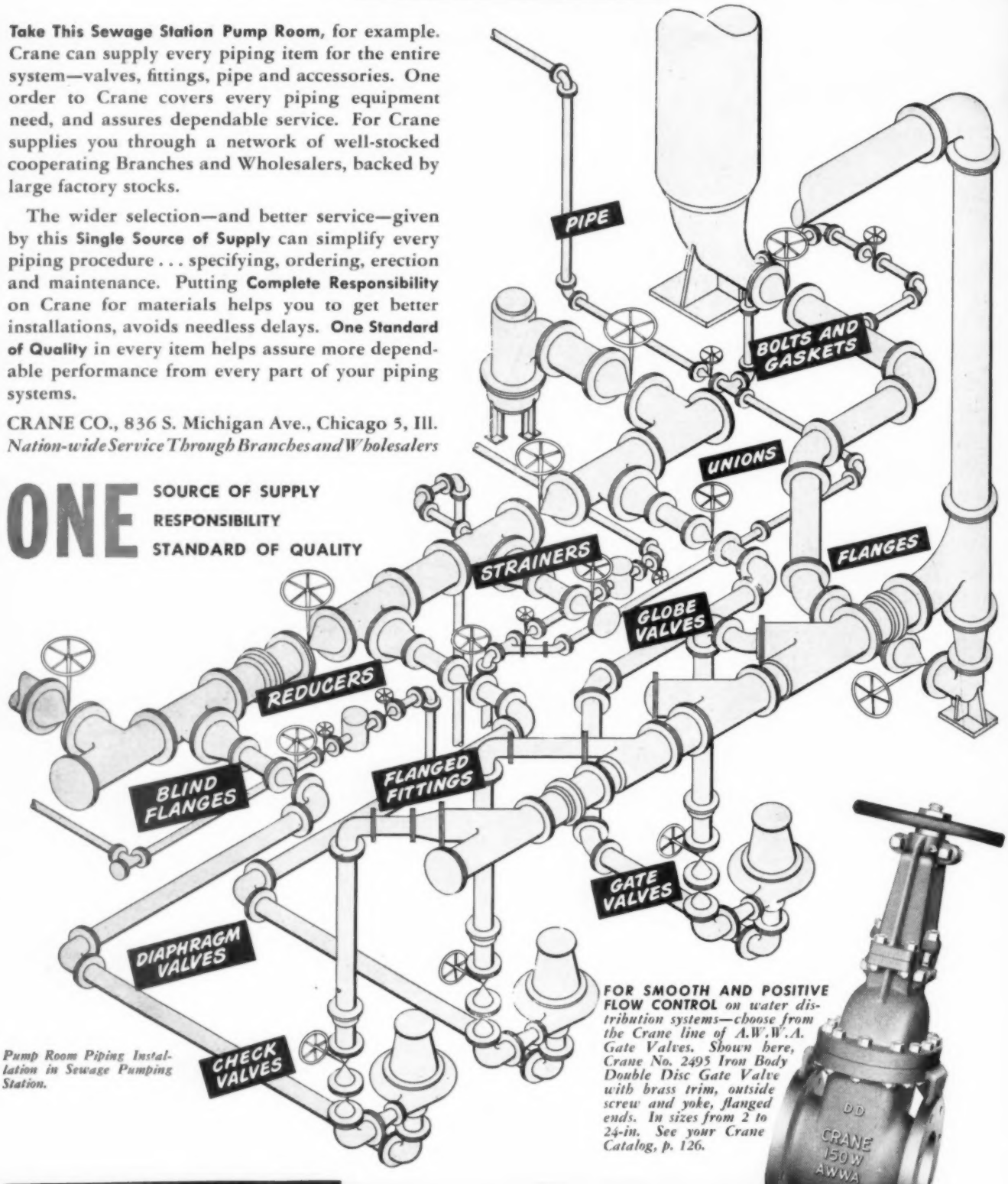


Pump Room Piping Installation in Sewage Pumping Station.

FOR SMOOTH AND POSITIVE FLOW CONTROL *on water distribution systems—choose from the Crane line of A.W.W.A. Gate Valves. Shown here, Crane No. 2495 Iron Body Double Disc Gate Valve with brass trim, outside screw and yoke, flanged ends. In sizes from 2 to 24-in. See your Crane Catalog, p. 126.*

EVERYTHING FROM . . .

CRANE

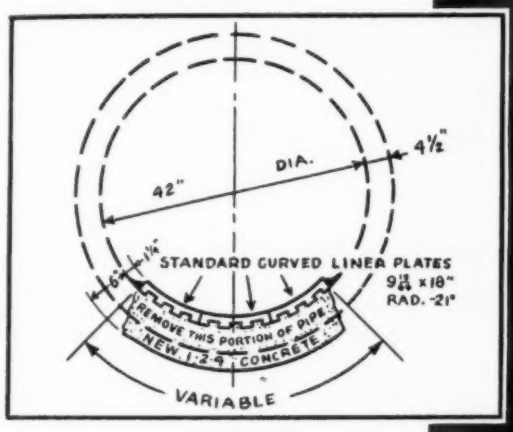
VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

FOR EVERY PIPING SYSTEM

Clay Liner Plates

SALVAGE RELIEF SEWER SYSTEM

THE Engineering Department of Cudahy, Wisconsin, recently devised an unusual method of salvaging a non-vitreous relief sewer which had disintegrated from constant attack by sulphuric acid discharged from a nearby drop forge plant. Vitrified Clay Liner Plates were used to replace the invert of the sewer to take care of the high-acid waste material flowing through the line. The sewer arch, which had not been in contact with the waste material, was saved.



Clay Pipe Passes A. S. T. M. Acid Test With Plenty To Spare

Forty-eight hours suspended in fiery solutions of sulphuric, nitric, hydrochloric, or acetic acids . . . that's the rugged A. S. T. M. test for acid resistance! And Vitrified Clay Liner Plates come through without so much as a pockmark! That's the reason Clay is specified by leading engineers the world over for sewerage and waste disposal systems of all kinds. Clay Pipe and Clay Liner Plates are made from nature's own chemically inert material . . . it *never wears out!*

C-849-2

WRITE FOR INFORMATION ON *YOUR* CLAY PIPE QUESTION

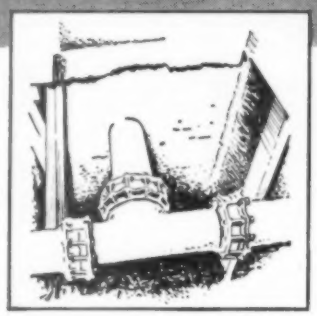
NATIONAL CLAY PIPE MANUFACTURERS, INC.

100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
522 First National Bank Bldg., Atlanta 3, Ga.
703 Ninth and Hill Bldg., Los Angeles 15, Calif.
1105 Huntington Bank Bldg., Columbus 15, Ohio

Vitrified CLAY PIPE NEVER WEARS OUT! CLAY PIPE

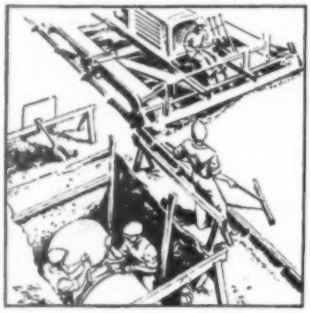
3 OTHER TIMES when it pays to clamp

Naturally, it pays to clamp whenever a leaky bell-and-spigot joint needs fixing. Clamping with Dresser Style 60s gives you a quick, permanent, positive repair. Here are three other times when clamping is good business:



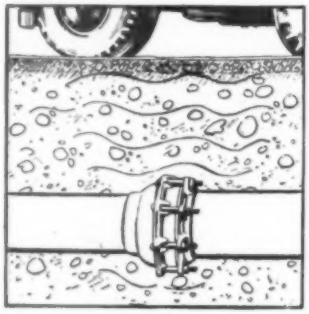
WHENEVER A JOINT IS UNCOVERED

Installing a Style 60 every time a bell-and-spigot joint is uncovered for *any* reason prevents future leakage and digging expense. Having already invested in excavation, clamping at this time becomes very cheap insurance.



AHEAD OF STREET PAVING

Here is the golden opportunity to save on digging and repaving costs. Dresser-clamped joints mean service won't be interrupted on supply mains by blown joints. And you won't be digging through new paving later at great expense and inconvenience to the public.



WHERE THERE'S MOVEMENT OR VIBRATION

On bridge lines, under railroads, below heavily traveled streets, or when mains are disturbed by near-by construction, the Style 60 protects against leaks—absorbs vibration and pipe movement.

★ Write today for Dresser Repair Catalog . . .

Dresser Style 60 Bell-Joint Clamp. Fully adjustable for tight fit, even on off-size pipe.

Dresser Style 82 "Adjustable" Sleeve. Quick, easy, permanent repair for breaks, splits, holes.

Dresser Style 126 "Bellpack". Repairs broken bells without requiring shutdown of line.

DRESSER CLAMPS and SLEEVES

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries) • In Texas: 1121 Rothwell St., Houston • In Canada: Dresser Mfg. Co., Ltd., 629 Adelaide St., W., Toronto, Ont. • Sales Offices: New York, Chicago, Houston, San Francisco.

140 ACRE FEET OF ROCK FILTER WITH P.F.T. FIXED NOZZLES AND DOSING EQUIPMENT

AT Akron, Ohio, one of the largest installations of P.F.T. Fixed Nozzles is providing highly satisfactory filtering of sewage, day after day, year after year. Patented, non-clogging deflector nozzles afford maximum utilization of the filtering medium, permitting dosing of practically 100% of the filter area. P.F.T. Dosing Siphons efficiently regulate the volume and frequency of dosing.

Not confined to large installations, P.F.T. Fixed Nozzle Plants are serving the sprinkling filter beds in thousands of communities of all sizes.

Where circular filter beds are indicated, P.F.T. Rotary Distributors assure maximum effectiveness of distribution. Minimum head is required for propulsion because of well-balanced design and sound bearing arrangement on center column. P.F.T. Spreader Jets provide complete coverage of filtering media with a minimum of clogging. P.F.T. Rotary Distributors are giving satisfactory performance for all types of filter application—whether conventional loading or high rate of loading, with or without recirculation.

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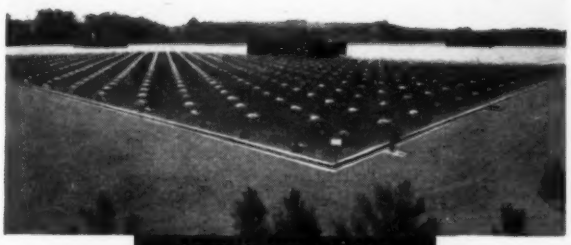

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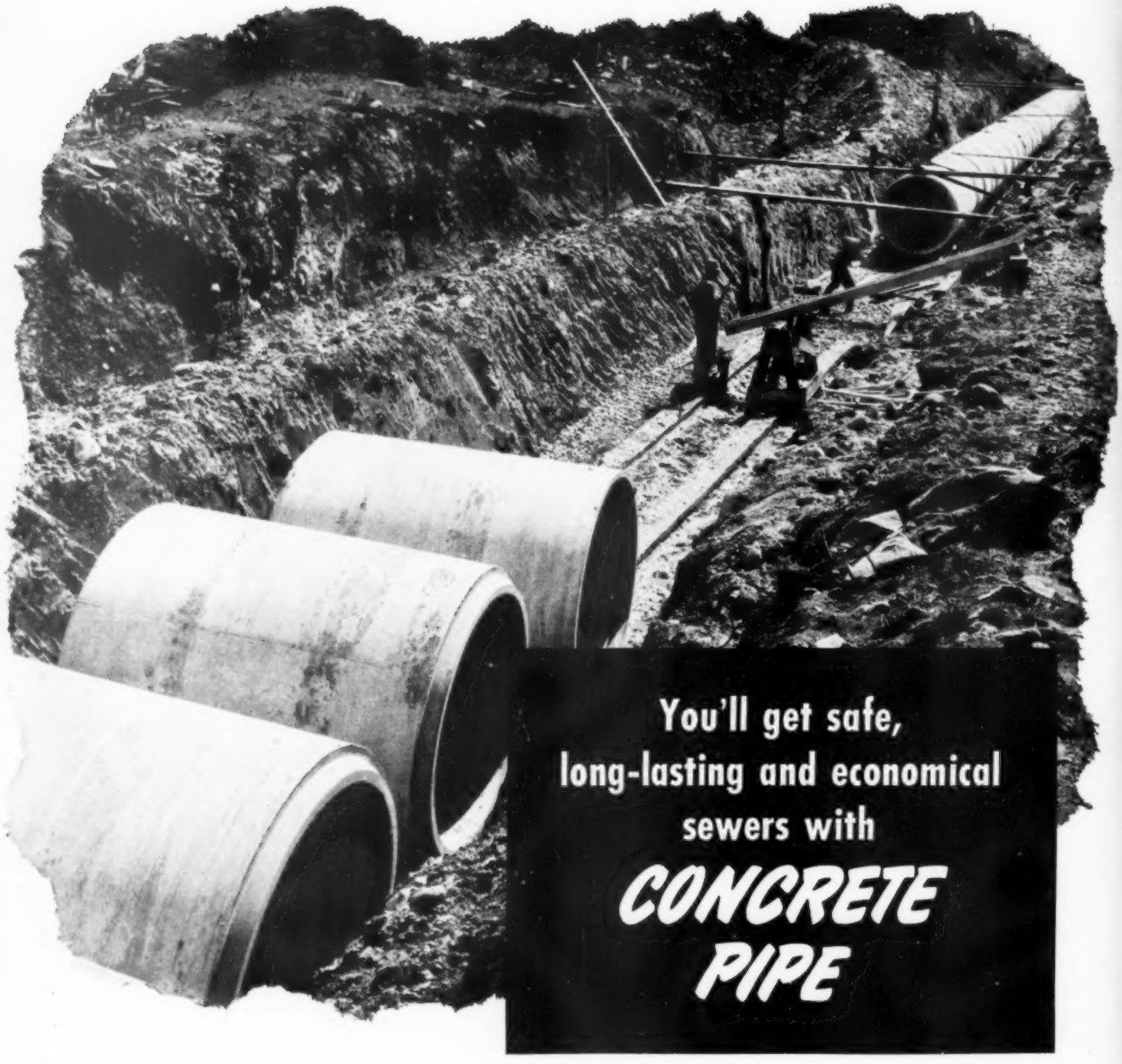

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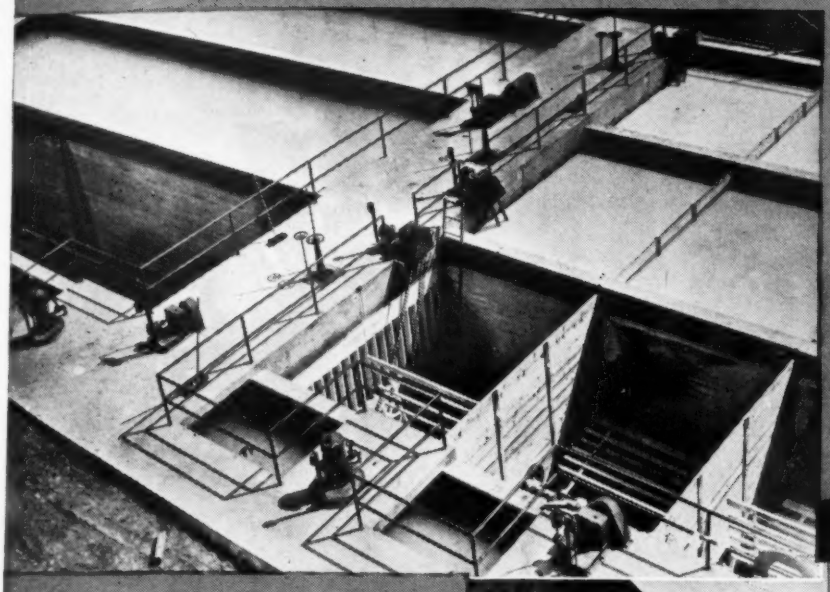

Left—One of the six FLOCTROLS installed in water softening plant in Rawsonville, Michigan, supplying the Kaiser-Fraser assembly plant.

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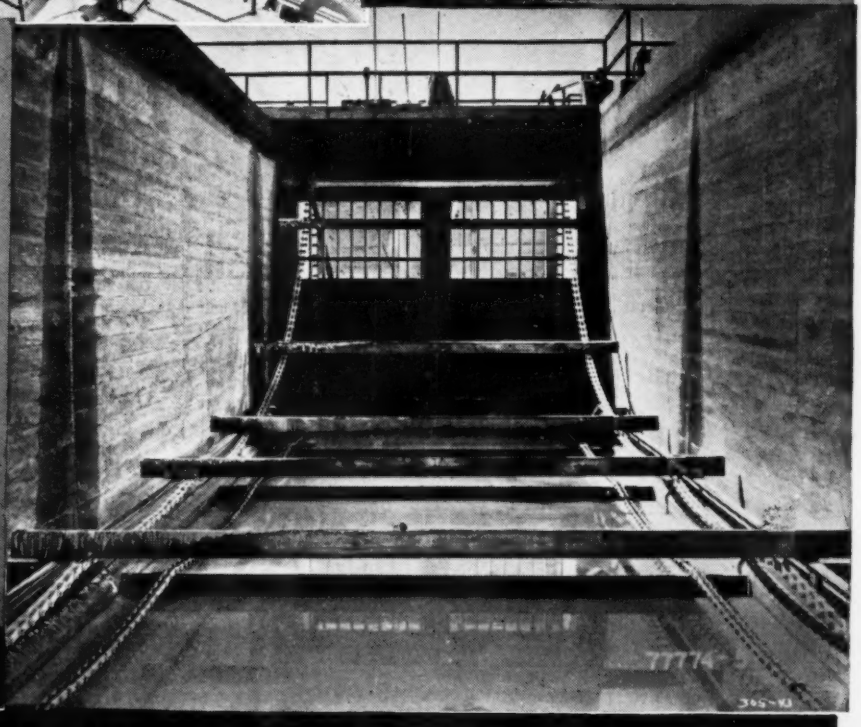

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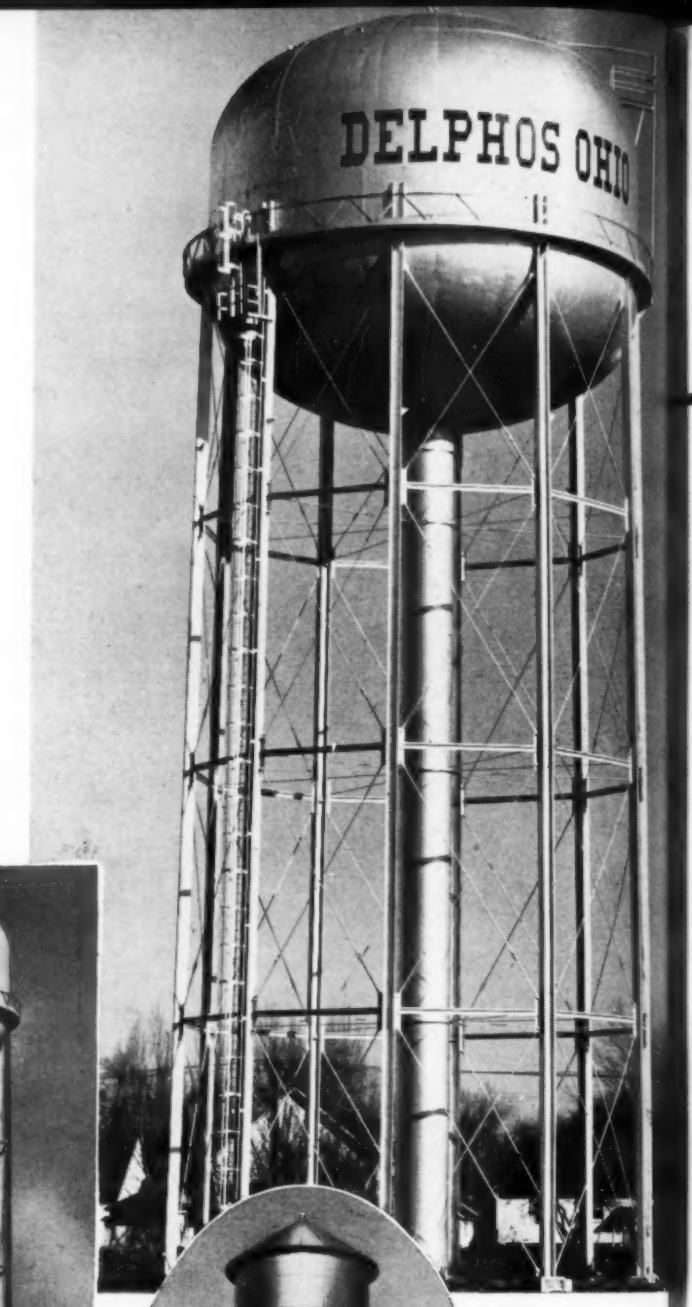

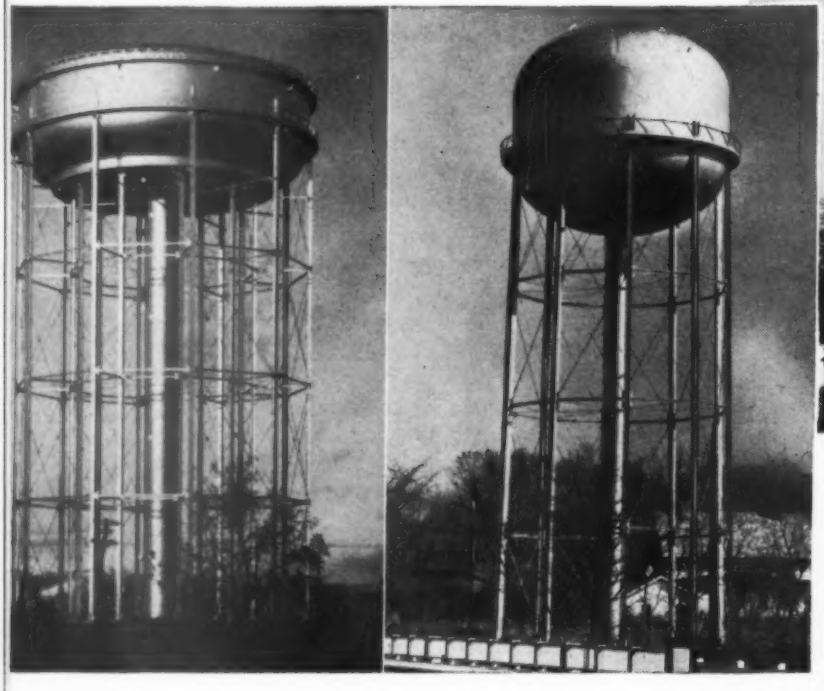

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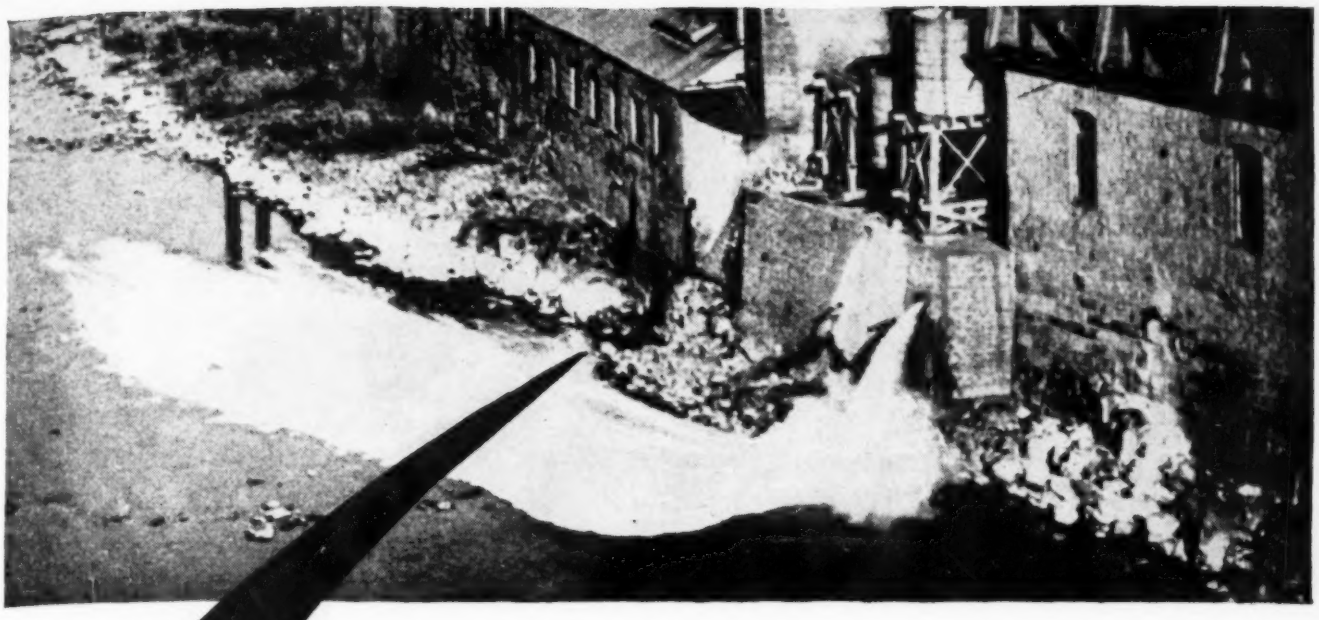

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WATER & SEWAGE WORKS

VOL. 96, NO. 6 JUNE, 1949

A Gillette Publication

THE 26TH WARD SEWAGE TREATMENT WORKS*

by

S. W. STEFFENSEN

Project Engineer and Deputy Chief Bureau of Sewage Disposal Design

DEPARTMENT OF PUBLIC WORKS CITY OF NEW YORK

SOMETIME in 1949, the old 26th Ward Sewage Treatment Works, having a great heritage of classic experimentation and being a Brooklyn landmark for more than 50 years, will be demolished. Replacing it will be a new plant, the construction of which is now nearing completion.

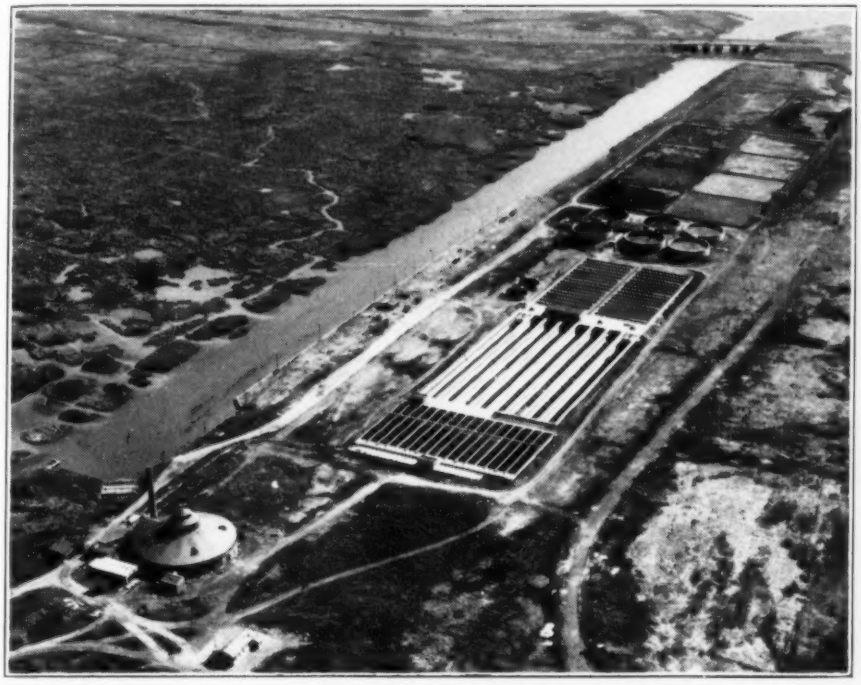
The new works ultimately will serve 480,000 people contributing 60 mgd. of sewage. Treatment will be by the activated sludge process plus chlorination of effluent. Some of the distinctive features of the design are screening and pumping stations for high and low level sewers; fixed porous air diffuser tubes; a new type of final tank; sludge disposal by dumping at sea or by drying on beds; and utilization of sludge gas for direct drive and for electric power generation.

The activated sludge type of treatment has been selected at this location because of the land-locked nature of the receiving waters and their value for recreational use. When this plant and the Rockaway Sewage Treatment Works are completed, all city sewage discharged into Jamaica Bay will have received at least a moderately high degree of treatment. It is the published intention of the city authorities to make this bay a great recreational area.

The plant site is on the Hendrix Street Canal at the foot of Hendrix Street near the Belt Parkway. Storm overflow and plant effluent discharge into the canal which outlets to Jamaica Bay about 3200 ft. from the plant outfall sewer. Docking facilities are on an easement south of the parkway.

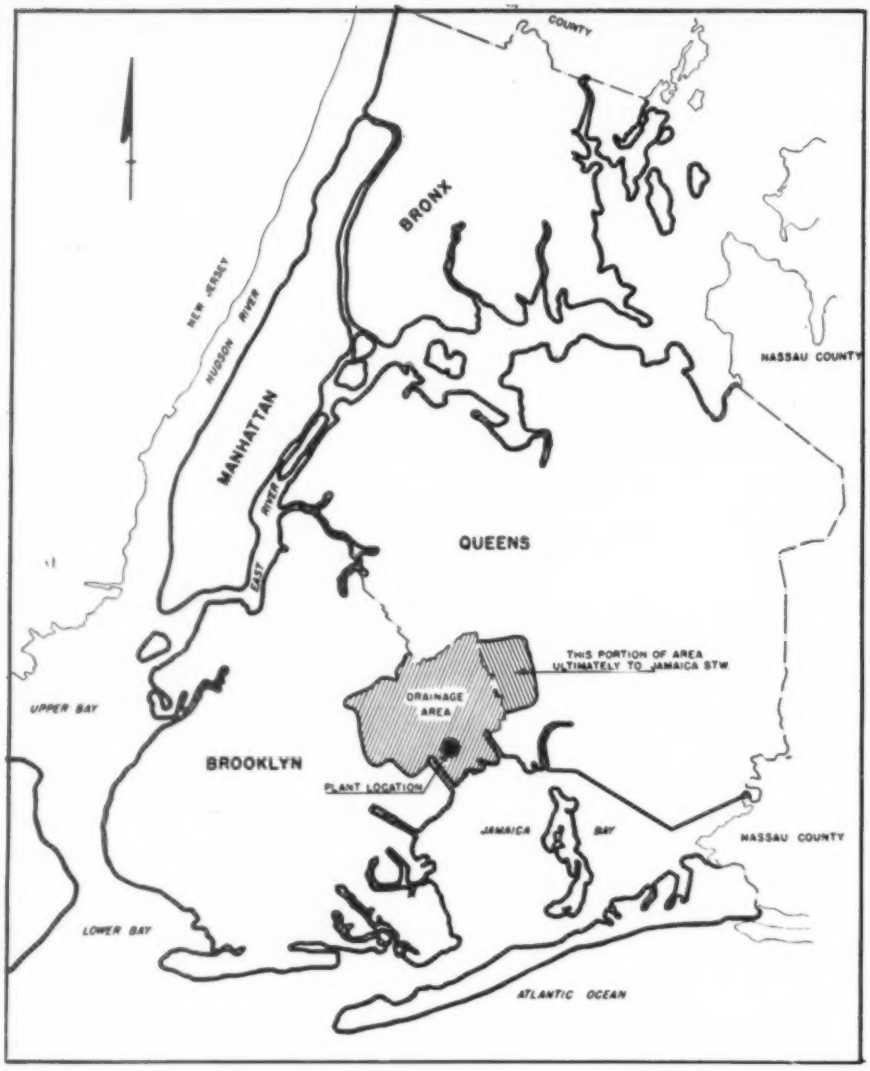
The extent of the drainage area is 5,842 acres in the East New York and Brownsville sections of Brooklyn. This area is delineated in the Master Plan of the City [1]. About 70 per cent of the area is sewered at present, and it is believed that substantially all will be sewered by 1970. An additional area of 1,291 acres in the Borough of Queens is now contributing sanitary flow through the Genesee St. pumping station. Ultimately this flow will be diverted to the existing Jamaica plant.

Construction of the plant was interrupted by the war. Partial treatment, consisting of summer-time prechlorination, plain sedimentation, sludge digestion in heated uncovered tanks, and sludge drying on open beds has been practiced since June, 1944.



Aerial Photograph Showing Old Plant and New Tanks and Sludge Drying Beds

*Presented at meeting of Metropolitan Section of the N.Y. State Sewage Works Assn., and released by the Fed. S.W.A. for publication in *Water & Sewage Works*.



Map of New York City Showing Location of 26th Ward Plant

History of the Old Plant

It seems appropriate at this time to recite parts of the long history of the 26th Ward plant to show the prominent place it occupied in the development of the art of sewage treatment during the past half-century.

The original treatment works was housed in the existing circular brick building, 140 ft. in diameter. The outlet sewerage system, including the sewage disposal works, was constructed mainly in the period 1890-1896. The cost of the treatment plant was $350,000. This period was one of extremely rapid expansion in the area so that although the plant was designed in 1888 to treat 3 mgd. of sewage from 35,000 people, by May, 1897, when operation started the population had reached nearly 60,000 and the flow probably about 6 mgd. The plant therefore from the beginning was inadequate although the then Engineer of Sewer Design, Geo. T. Hammond, [2] says that for a time it rendered fairly good service.

The original plant used the J. J. Powers process of chemical precipitation with lime, and sludge disinfection by chlorine. The design also may have included post-treatment dosing with ferric chloride, a dubious step but one which was employed in earlier Powers' plants, among them the one at Sheepshead Bay, N.Y., known as Caisson No. 4, [3]. However, either by design or innovation, ferric chloride was at times used in pre-treatment dosing to augment the lime. The sewage received its charge of milk of lime (and sometimes ferric chloride) before entering one of two semi-circular sedimentation channels, whereupon it traversed a distance of 350 ft. and passed through bar screens before reaching the wet well at the center of the building. The effluent was pumped by steam power to a 26 ft. wide open flume discharging into Jamaica Bay, 3,800 ft. distant.

Early Use of Chlorine

Chlorine was used to disinfect the sludge which was removed from the channels periodically in buckets, elevated to tram cars and dumped on the surrounding marshes. The chlorine was also intended for possible chlorination of the sewage. Since such provision goes at least as far back as 1886, when Caisson No. 2 on Coney Island Creek was put into operation, we must take our hats off to Mr. Powers, certainly one of the first men to put chlorine gas into sewage. The chlorine was generated by mixing common salt and manganese dioxide in aqueous solution and adding sulphuric acid.

The inefficiency of the plant was clearly realized when the Brooklyn Chief Engineer of Sewers, Mr. E. J. Fort, stated in a report dated January 23, 1908 [4] ". . . the present plant (which is at best only a make-shift and a pretense), designed to treat 3 million gallons per day, is now receiving in the neighborhood of 10 million gallons per day, with the result that the sewage flows from the plant in fully as foul a condition as it reaches it, the only effect of the treatment it receives being that the effluent contains a quantity of lime, and putrefactive action is delayed several hours." About 1910 or 1911 the 42 in. diam. sewer from Brownsville and the low-level pumping station were constructed, thus imposing more load on an already overloaded plant.

Experiments on Activated Sludge

At the 26th Ward plant, Black and Phelps in 1910 made their studies of the aeration of sewage which showed that aeration with compressed air was feasible and promising. This apparently touched off a chain of experiments including the historic ones at Lawrence, Mass., and Manchester, England, the latter culminating in the announcement of the activated sludge process in May, 1914.

To continue the studies started by Black and Phelps and to determine the type of treatment best suited for a new plant, the Board of Estimate and Apportionment in 1912 appropriated $50,000. In that year Mr. Fort, still Chief Engineer of Sewers, and Mr. Geo. T. Hammond, Engineer of Sewer Design and in charge of experiments, visited all notable American plants and the more important ones in Great Britain and Europe, gathering data both for the experimental and permanent plants.

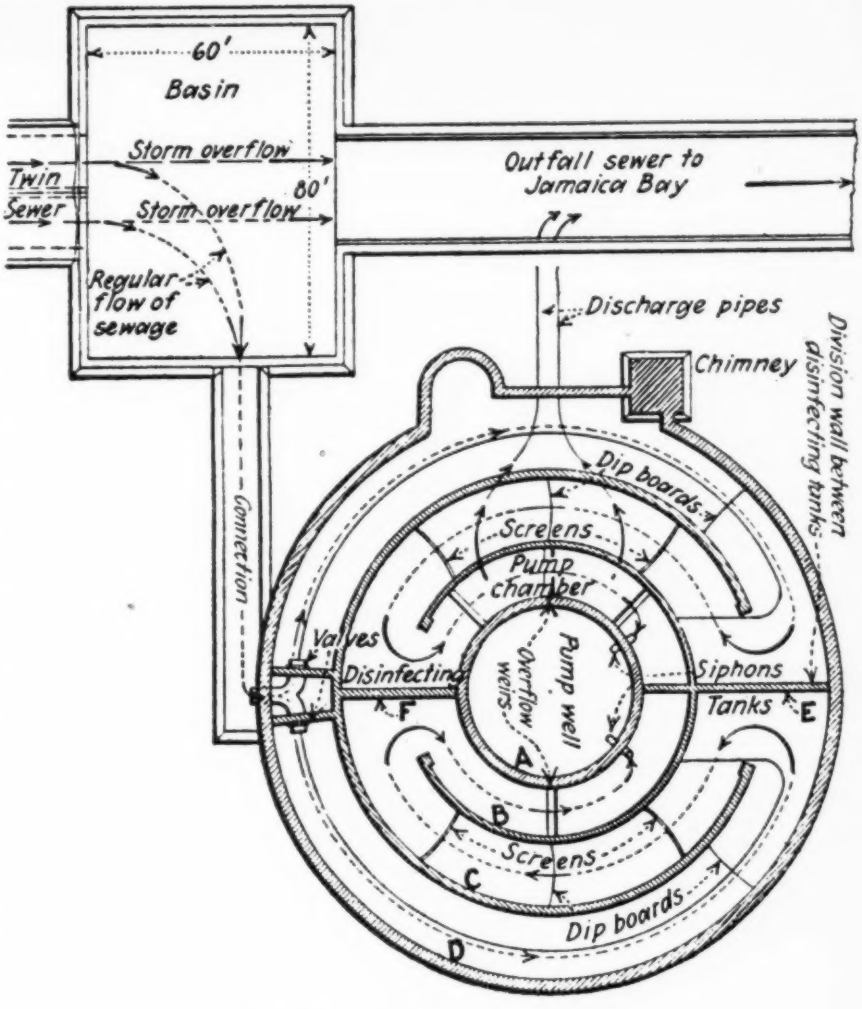
The experimental plant [3, 5] included three Imhoff tanks, six trickling filters (two with forced aera-

tion), an aeration tank, a Beddoes siphon aerator, a plain sedimentation tank, nine final settling tanks, a separate digestion tank, ten sludge drying beds, and two permanent 14 ft. dia. Riensch-Wurl disc type fine screens. Experiments were started mainly in 1913. Those on activated sludge were begun early in March, 1915 [6, 7]. Work with the screens commenced upon their installation in April, 1916, and all experiments continued until January, 1918.

The recital of a few additional dates will emphasize the progressive nature of the men who conceived and initiated this experimental work. Imhoff tanks were first installed in America in 1911 (Madison-Chatham, N.J.), and the first large installation was made in 1912 (Atlanta, Ga.). Although sludge lagooning dates back to the last century (Essen, Germany, 1891), the first recommendation of separate digestion was made in 1906 by Hazen for Paterson, N.J., and the first installations here and abroad were made in 1912 (Birmingham, England, and Baltimore, Md.). It is believed that the 26th Ward Riensch-Wurl screens were the second installation in this country, the first being at Daytona Beach, Fla., in 1915. A flood of tank-scale experiments on activated sludge was launched all over the country following the announcement of the new process, those at 26th Ward being about fourth to get under way.

The five years of experimental work supplied performance data on trickling filters and fine disc screens; showed that the activated sludge process results were good but indicated that costs by the method used were high compared to trickling filters; and demonstrated some of the advantages of separate digestion. We must pay tribute to the men whose pioneering spirit engineered a broad research at such a relatively early date in the history of sewage treatment. Among them, in addition to Messrs. Fort and Hammond, were Mr. William T. Carpenter, who served ably as Chief Chemist, and Dr. Hering, Dr. Imhoff and Prof. Phelps, who gave expert advice.

Despite the high hopes of the early planners and the recommendations of the Metropolitan Sewerage Commission [8], improvements at the plant were delayed and limited to converting the works in 1925 to a fine screening plant. At this time new storm and sanitary outlets were built at the plant and a wide channel dug to Jamaica Bay, Edison electric power substituted for steam, the circular building drastically altered to accommodate the two original 14 ft. diameter R-W screens (which were remodeled), two new 26 ft. diameter fine screens of the same type, and new pumping equipment. The disc screens served efficiently within their limits until May, 1946, when their use was discontinued.



Plan of Original 26th Ward Plant (1896)

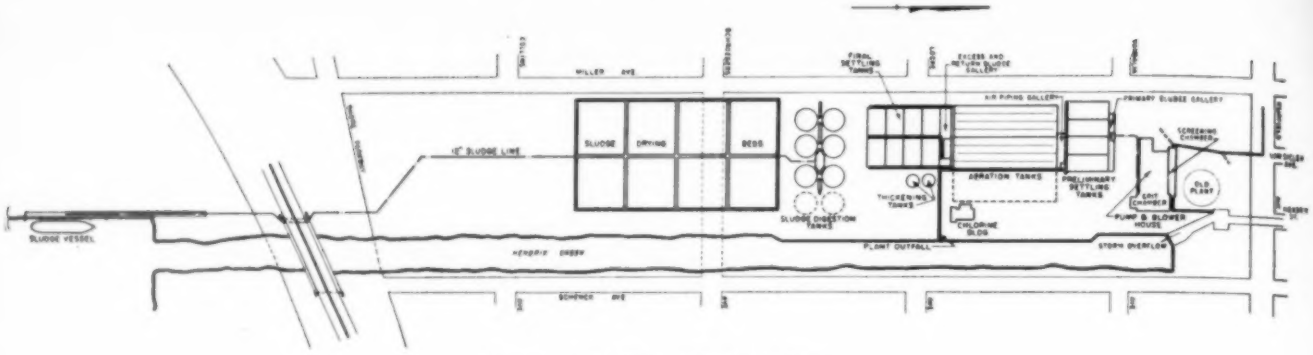
Since its conversion to a fine screening plant, the only major changes in the old works occurred in 1937 when a large sewage pump and chlorination facilities were added. This pump and two of the chlorinators will be used in the new plant.

The New Plant

Population and Sewage Flows. As previously stated, the plant is designed to treat an average of 60 mgd. of sewage from an estimated ultimate population of 480,000 in 1970, (125 gcpd.). The connected population at the time of the 1940 census was 394,000, and the average flow for that year 46.1 mgd. When the full plant is put into operation in 1949 it is expected that the flow will be about 50 mgd. from 415,000 people. The maximum flow through the plant is to be twice the mean dry weather flow, while the excess in time of storm will be rejected to tide water.

Sewage Characteristics. The sewage is largely domestic in character, showing an average analysis in 1947 of 172 ppm. suspended solids and 160 ppm. biochemical oxygen demand. Assumptions for plant design were slightly higher than these figures, namely 192 ppm. S.S. (which is equivalent to 0.20 dry lbs. per capita daily) and 182 ppm. BOD. (or 0.19 lbs. per capita daily).

Sewers. Most of the trunk sewers in the area are large combined sewers laid to very flat grades. Storm overflows are provided at Fresh Creek Basin and the Hendrix St. Canal and another is planned at Spring Creek Basin. Sewage reaches the plant through a 187 in. equivalent diameter high level combined sewer in Hendrix Street and a 42 in. diameter low level intercepting sewer in Fairfield Avenue. About three-



Layout of the New 26th Ward Plant

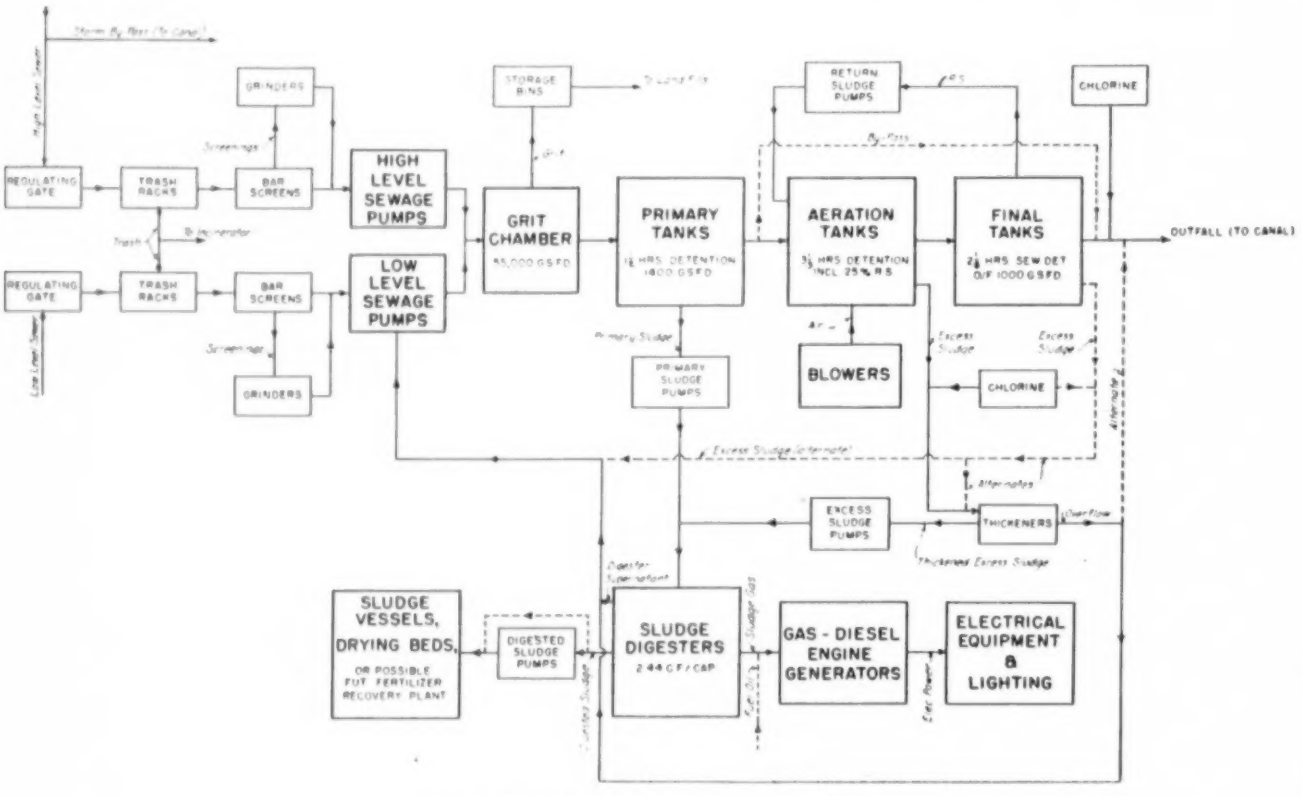
fourths of the present flow to the plant comes in at the high level. Diversions from the high level and new sewers leading to the low level will result in a condition wherein ultimately the flow will be about evenly divided between the two levels.

Pump and Blower House. The pump and blower house is the main building at the plant. It accommodates the screening chambers, grit chamber, wet wells, sewage pumping equipment, blowers, air filters, engine-generators, electrical equipment, office, laboratory, work shop, and lunch, locker, and boiler rooms. The superstructure is 109 ft. by 226 ft. not including several projections, and does not extend over the screening chambers or wet wells. The building is of a modern industrial design featuring gray tone face brick, cast stone trim, rigid frames, glazed structural facing tile interiors, and broad expanses of window on the north and west sides of the main operating room. The pump and blower house, as well as all of the main structures at the site, is supported on timber piles.

Screening Chambers. Because of a 10 ft. difference between the high and low level sewers, the design calls for two separate screening chambers with similar equipment. The sewage enters each chamber through a hydraulically-operated regulating sluice gate. Each chamber has two channels, either of which is hydraulically capable of passing the maximum flow. The channels are 5 ft. 6 in. wide and are equipped with 3-in. trash racks followed by 1 in. bar screens, both mechanically cleaned and of the Laughlin back-raking type. The specification limited the trash rack to this type but permitted the use of the Laughlin, reciprocating rake, or chain types for the secondary bar screen. The Department's experience indicates that the back-raking screen is especially desirable as a coarse rack because jamming by heavy timbers and other large objects is practically eliminated. Trash will be removed in cans while screenings will be ground and returned to the sewage.

Velocities just ahead of the bar screens are controlled between approximately 2 and 3 ft. per sec. by means of critical depth effluent channels. The screening chambers discharge into separate wet wells.

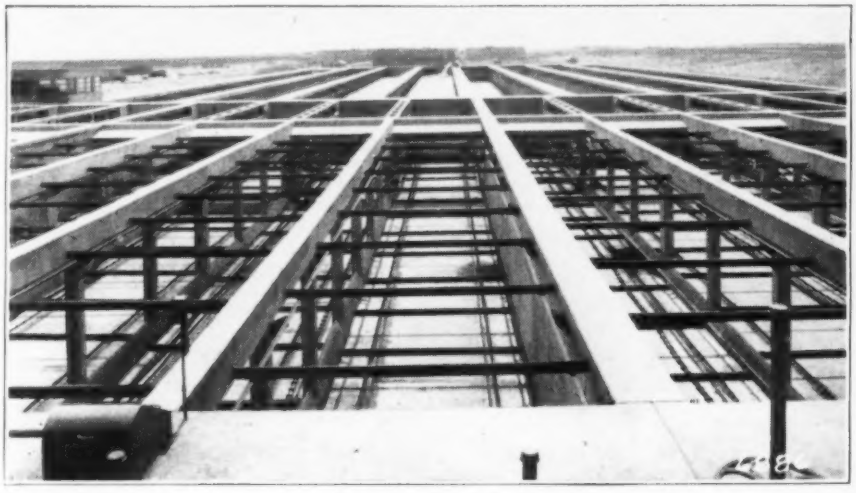
Main Sewage Pumps. Three vertical pumping units are provided for the low level and three for the high level sewage. All are rated at 30



Flow Diagram of the New 26th Ward Plant

mgd. capacity except two in the high level pump well which are 35 mgd. Maximum total dynamic heads are 35 ft. for the high level and 47 ft. for the low level. Hydraulically operated cone check valves are used on the discharge side and manually operated gate valves on the suction side. A 66 in. diameter steel force main carries the screened sewage to the grit chamber where it rises vertically into the influent well.

Sewage pumps, blowers and generators are all located in the main operating room of the pump and blower house. The equipment is serviced by a 10-ton manually-operated crane with a 5-ton auxiliary electric hoist.



Preliminary Settling Tanks

Blowers. The blower installation consists of one 20,000 cfm. gas engine driven rotary blower (from Tallmans Island S.T.W.) and two 17,500 cfm. electrically-driven centrifugal blowers. Average load is expected to be between 20,800 and 25,000 cfm.; or 0.50 to 0.60 cu. ft. per gal. for 60 mgd. Maximum design load with one unit out of service is 35,000 cfm. or 0.84 cu. ft. per gal. Air will be cleaned by two 35,000 cfm. roughing filters of the viscous impingement self-cleaning type and two secondary dry filters of like capacity. Venturi meters are provided for inlet air to the centrifugal blowers and for discharge air to each aeration tank and the return sludge channel.

Power. The electric generator installation consists of three — 1300 bhp. dual fuel engines direct connected to 1125 KVA (900 KW), 4160 volt generators. Space is provided for one additional unit. Engine fuel will consist of sludge gas, plus diesel oil for ignition and supplementary uses. Power requirements are estimated at 1600 KW for average design load and 2500 KW for maximum design load. Average gas production is estimated at 1.0 cu. ft. per cap. per day, or a total of 480,000 cu. ft. per day. It is expected that roughly three-fourths of the average engine fuel requirements will be derived from sludge gas and the balance from oil.

Grit Chambers. The grit removal facilities have been designed to follow the pumping operation because the experience of some years with both "high" and "low" grit chambers indicates that the former are superior from the viewpoint of improved operation and maintenance, in spite of the additional scouring of the pumps. Alternate designs were made for detritor type and conventional channel type of chamber, the latter being selected as a result of competitive bidding.

Four 12 ft. wide channels, including one spare, are provided. The settling rate at maximum flow (40 mgd. per channel) is 55,000 gal. per sq. ft. daily. Velocity at various flows is controlled between 1.01 fps. and 0.64 fps. by critical depth channels. This degree of control is considered adequate as the grit is washed. Washers are of the reciprocating jig type. Grit is ejected to overhead storage bins for removal by truck to land-fills or incinerators. The sewage flows by gravity from the grit chamber through a 78 in. pipe and a venturi meter to the primary settling tanks.

Primary Settling Tanks. These tanks are four in number and allow an average detention of 1½ hr. The settling rate is 1400 gal. per sq. ft. daily. The collector flights act as skimmers on the return passage and scum is squeegeed by hand into a collecting trough. Scum may be removed from a manhole in cans or pumped to the digesters. The settled sewage flows over side weirs on which the head is 1 in. at average flow. Metal weirs were originally specified, but creosoted wooden weirs were installed as a war-time substitute and have proven entirely satisfactory.

Pumping equipment in the primary gallery consists of three 130 gpm. and one 160 gpm. triplex plunger sludge pumps, and one 100 gpm. duplex plunger scum pump. The sludge line to the digesters is 8 in. in diameter up to the point at which it is joined by the excess sludge line, where it enlarges to 12 in.

Aeration Tanks. There are two aeration tanks, each containing four passes 30 ft. in width. The tank walls are curved in cross-section to aid the spiral flow. The aeration period is 3⅓ hr. for average flow plus 25 per cent return sludge. Fixed porous tubes will supply air at the rate of 4.0 cfm. per tube when using 0.5 cu. ft. per gal. of sewage for 60 mgd. Provision is made for step-aeration by introducing the settled sewage into the first, second and third passes. Tank effluent passes over concrete weir walls and thence into the final tank influent channels.

Final Settling Tanks. The final settling tanks, eight in number, are designed for an overflow rate of 1,000 gal. per sq. ft. daily. The detention period is 2.16 hr. based on sewage flow, or 1.72 hr. with 25 percent return sludge. In an attempt to achieve optimum efficiency in dealing with density currents, sludge will be scraped in the direction of the incoming sewage, the path of the return flights is in the mid-depth of the tank, and overflow will be drawn off over side weirs near the inlet end of the tank. Weir plates will be adjustable and constructed of aluminum. The head at average flow will be one-half inch. Return sludge will be collected in hoppers from which riser pipes with adjustable bell-mouth outlets will convey it to sludge boxes. A common aerated channel, equipped with fixed porous tubes, leads to the return sludge pump well.

Sludge Thickening Tanks. Two 48 ft. diameter thickening tanks with 15 ft. side water depth are provided. They will be equipped with "picket fence" thickening and collecting mechanisms. The tanks ordinarily will be fed aerator effluent at approximately 1500 ppm. suspended solids. As an alternate method of feeding, sludge may be introduced from the return sludge well at per-

View of Aeration Tanks During Filling for Leakage Test
(Note original circular building in background)

haps 7500 ppm. suspended solids. Thickener effluent will pass over adjustable V-notch aluminum weirs and may be returned to the head of the plant via the main plant drain or admitted directly to the outfall sewer.

Return and Excess Sludge Pumping Facilities. Sludge will be returned to the aerators by means of four low head variable speed centrifugal pumps, each rated at 12 mgd. capacity. Hence it will be possible to return a maximum of 60 per cent with one pump out of service. Venturi meters are provided for both return sludge and settled sewage flowing to each aeration tank.

Excess sludge is to be pumped from the thickeners to the digesters by means of two triplex plunger pumps at 160 gpm. capacity each and one quadruplex high head plunger pump at 250 gpm. capacity.

Sludge Digestion Tanks. The initial digester installation consists of six tanks, each 86 ft. in diameter and of 260,000 cu. ft. capacity. The per capita volume is 2.44 cu. ft., which will provide a digestion period of about 38 days based on input. Provision is made for the possible future addition of two tanks which will raise the capacity to 3.25 cu. ft. per capita and the period to 50 days. Four of the six initial tanks will be equipped with Downes floating covers and two with spirally guided gasometer covers, the latter providing a total gas storage of 140,000 cu. ft., or 7 hours, at an average yield of one cu. ft. per cap. daily. A good deal of flexibility has been introduced in the piping arrangement so the tanks may be operated single or double stage. The digesters are embanked with earth for insulation, and piping is placed in an interconnecting tunnel running in either direction from the digested sludge pumping station.

Waste heat from the engines will be used to maintain the digesters at 85° to 90° F. Steel pipe heating coils are installed in all tanks and additional heat will be supplied to three tanks when used as primaries, by means of preheaters not yet installed.

Two quadruplex plunger pumps each of 400 gpm. capacity will be used for purposes of transfer, feeding drying beds or loading sludge vessels. A 1000 gpm. centrifugal pump is included for rapid execution of the last named function, and space is provided for an additional plunger pump.

Sludge Disposal Facilities. Digested sludge will be pumped through a 12 in. pipe line to sludge vessels and disposed of at sea. Mooring facilities are located in the Hendrix St. Canal at its point of discharge into Jamaica Bay, south of the Belt Parkway Bridge. These facilities consist principally of pile clusters and an access walkway. Eight crude open sludge drying beds without underdrains and having a total surface area of 280,000 sq. ft. will serve as an alternate or emergency means of sludge disposal. These beds have been functioning under partial treatment. Space is available at the site should it become advantageous in the future to construct a sludge drying plant.

Chlorination. The chlorine building is an isolated structure in which all of the chlorinating equipment and storage space for 40 one-ton containers are located. Two 2000 lb. per day chlorinators salvaged from the old plant will supply chlorine for sewage effluent. Space allowance has been made for two additional future chlorinators. In addition two 300-lb. chlorinators are available for stabilizing thickener influent. The anticipated dosage of plant effluent is 5 ppm. or 2500 lb. per day as an average, and twice this as a maximum. Safety provisions include a ventilating and caustic spray system and also means for flooding the storage pits with city water and 50 per cent caustic soda solution, stored in three 6000 gal. tanks.

Landscaping. The plant will be landscaped in such a manner as to present a pleasant appearance which will permit development of the surrounding territory for residential purposes. Featured will be grassed areas and trees, with shrubs at various points to complement the effectiveness of the treatment.

Operation Under Partial Treatment

The results achieved under partial treatment have been substantially what might be expected, or slightly better. In 1947 removals of suspended solids and B.O.D. in the settling tanks were 63 and 43 per cent respectively. Sludge to the digesters averaged 6.9 per cent solids and that to the drying beds 12 per cent. Volatiles in the raw sludge were reduced 53 per cent by the digestion process, and digester supernatant, which temporarily has been discharged into the canal, averaged only

Table I.
ESTIMATED CONTRACT COST

Contract No.	Title	Contractor	Cost
1A	Test Borings	Sprague & Henwood, Inc.	$ 1,967 (final)
1B	Soil Bearing Tests	Giles Drilling Co.	2,043 (final)
2	Bulkhead & Prep. of Site	Johnson, Drake & Piper, Inc.	357,605 (final)
3	Gas Engines & Generators	Rathbun-Jones Eng'g. Co.	333,400 (modified bid)
4	Structures & Equipment	E. W. Foley Assoc. Co., Inc.	1,834,351 (final)
5	Piping	E. W. Foley Assoc. Co., Inc.	432,167 (final)
6	Sewage Pumps	Worthington Pump & Mach. Corp.	161,660 (bid)
7	Blowers	Turbine Equip. Co., Inc.	129,750 (bid)
8	Buildings & Equipment	Tobias Heller & Son, Inc.	2,839,476 (bid)
9	Electrical Equipment	E-J Electric Install. Co.	748,696 (bid)
10	Plumbing	H. Sand & Co., Inc.	217,986 (bid)
11	Heating & Ventilating	Jacobs Engineering Corp.	429,700 (bid)
12	Roads, Drains & Landscaping	(not let)	287,000 (est.)
4A	Completion of Structures and Equipment	(not let)	420,000 (est.)
	Portable tools, equipment, etc.	Dept. of Purchase	35,000 (est.)
		Project Total	$8,230,801

250 ppm. in suspended matter and 96 ppm. in B.O.D. The sludge drying beds have worked satisfactorily. The sale of scum from the primary tanks has brought some return to the City, although at times the presence of large quantities of garage wastes from an unidentified source have rendered the scum unsaleable and its removal from the tanks particularly onerous. The digesters have been heated by means of a temporary coal-fired boiler and in the wintertime temperatures in the tanks, which are uncovered, have fallen to 70° F.

Cost of Construction

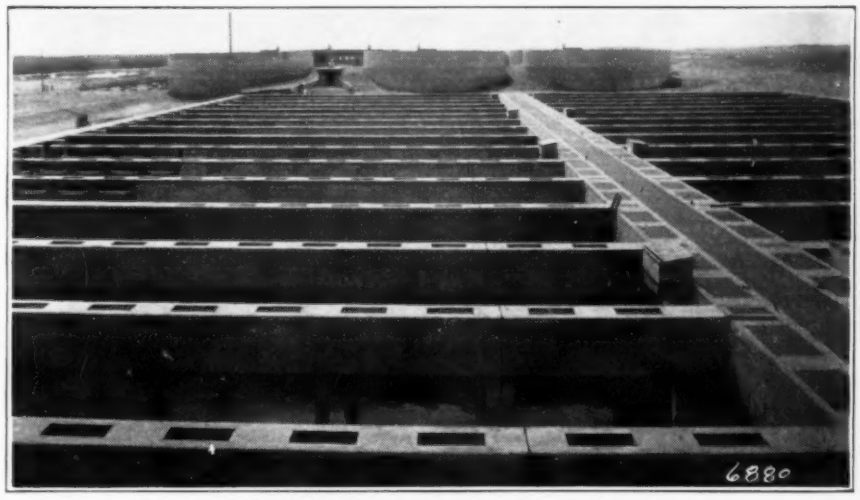
The total cost of the new treatment works is estimated at $8,230,801. The breakdown by contracts is shown in Table I. The unit cost will be about $137,000 per mgd. The earlier contracts (through Contract 5, as listed) were entered into at prewar prices while the later contracts have been or will be made at inflated postwar prices. The project is financed wholly by the City of New York.

Organization

The design, supervision of construction, and operation under partial treatment have been done entirely by personnel of the Department of Public Works of which Frederick H. Zurmuhlen is Commissioner, Joseph B. Diamond, Deputy Commissioner, and Richard H. Gould, Director, Division of Sewage Disposal.

Design was mainly under the direction of Wellington Donaldson, formerly Chief, Bureau of Sewage Disposal Design, Henry Liebman, formerly Engineer of Design; John W. VanDenburg, Victor Greiff and Albert B. Bauer, Section Chiefs; and the author. Construction is under the supervision of A. R. Glock, Chief, Bureau of Sewage Disposal Construction; and B. Morrison, Resident Engineer. Operation of the plant is under Nathan I. Kass, Chief, Bureau of Sewage Disposal Operation; and Paul E. Bardet, Plant Superintendent.

The author wishes to thank the many of his associates and superiors who have commented on the manuscript of this paper and aided otherwise in its preparation. Especial thanks are due to Mr. John C. Riedel, Chief Engineer of the Board of Estimate, whose long memory of the early days at 26th Ward has clarified several points.



View of Final Settling Tanks with Digesters in Background

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FLOURIDATION OF THE WATER SUPPLY OF MADISON, WISCONSIN

A Report of Revisions in Method and Practice

by
L. A. SMITH, Supt.
Water and Sewage Works
Madison, Wis.

Since writing the article "Fluoridation as Practiced at Madison," which was published in the April issue of *Water & Sewage Works,* three developments have occurred which should be noted.

1. We have adopted the use of 70% hydrofluoric acid in place of the 60% acid formerly used. The 60% acid has a certain amount of sulphuric acid in it to bring up the acidity, while the 70% acid is practically pure HF. The advantage of the 70% acid is that it is less corrosive and, being a stronger acid, there is less material to handle. It should be noted that hydrofluosilicic acid might be used in place of hydrofluoric acid. It would have the advantage of being less dangerous to handle, as it does not cause acid burns. It has the disadvantage that, based upon fluorine content, it is slightly more expensive.

2. The city water in Madison has a hardness of approximately 20 grains per gallon, made up largely of calcium and magnesium bicarbonates, and has a pH of 7.5. We find that at the point of discharge of HF into the city water, the end of the HF discharge pipe tends to clog due to the formation of insoluble calcium fluoride from the reaction of HF with the calcium in the water. To eliminate this trouble, we are arranging to discharge the HF directly into the clear well above the surface of the water so that there is no chance of calcium fluoride being formed. The vapors of HF are readily soluble in water so that no difficulty is expected from this method.

3. In the original article, I suggested that three types of material were being used in the pipe and fittings; namely steel, "teflon" and hard rubber, and that it was necessary to use iron valves with neoprene diaphragms. We now find that Monel Metal pipe, fittings, gate and check valves are superior, and these will be adopted for future installations.

MICH. SCHOOL OF PUBLIC HEALTH HOLDS INSERVICE COURSE

First High Level Course in Selected Problems in Sewage and Waste Treatment

"THE Most Probable Number of coliform organisms is not a result; it is only a means to a result." — "Stream Standards don't mean much and are hard to apply in the field."—"Coliform organisms may be present when pollution is absent." —Such statements as these would have been rank heresy when this reporter went to school, but they are merely representative of the latest information on water pollution and waste treatment as expounded at the University of Michigan on March 14 and 15. The occasion was the first "Inservice Training Course in Selected Technical Problems in Sewage and Industral Waste Disposal," offered under the auspices of the School of Public Health of the University of Michigan.

Host
H. E. Miller
Res. Lecturer
School Pub. H'lth
Univ. of Mich.

Presider
T. J. Powers
San. Engr.
Dow Chem. Co.
Midland, Mich.

This was a distinctly high level course, designed particularly for that group of sewage plant personnel, industrial waste treatment technical personnel, consulting engineers and others familiar with the fundamentals of sewage and waste treatment. Each of the seven lecturers, chosen by a committee of the Michigan Sewage Works Assn., was asked to present material not found in the textbooks or current literature. The result was that those attending were permitted to see into the future of sewage and waste treatment, for they were able to learn where the profession now stands in unlocking the door to many of the secrets that have held us back for many years. Ours is not a really young profession, but it has moved slowly through the past century, and it is refreshing to find that through such meetings as this, the acquisition of knowledge is being "kicked into high gear."

Credit for this type of meeting and its success must be shared by the University of Michigan School of Public Health, (which has put on some 30 previous inservice training programs on various other subjects) and the Michigan Sewage Works Assn., which requested the University to offer this two-day course. Actual work on the development of the course was done by a committee composed of Jack E. Cooper, Waste Disposal Engr., Ford Motor Co., Dearborn, Mich.; Austin Habermehl, Chemist, Detroit Sewage Treatment Plant; Harry E. Miller, Resident Lecturer in Public Health Engineering, School of Public Health, Univ. of Michigan; Loring F. Oeming, San. Engr., Stream Control Commission, Lansing, Mich.; Donald M. Pierce, San. Engr., Mich. Dept. of Health, Lansing, Mich; and Henry F. Vaughn, Dean, School of Public Health, Univ. of Mich.

Attendance totalled 116, plus half a dozen guests and seven lecturers. Most of the registrants came from Michigan, but there were attendees from ten other states and one from Denmark. Perhaps facilities would not have accommodated many more, but if there had been a little more publicity no doubt the lecture hall would have been more than crowded. Presiding on the first day of the meeting was John M. Hepler, Director, Bureau of Engineering, State Board of Health, Lansing, Mich. Thomas J. Powers, Project Engineer, Waste Disposal Division, Dow Chemical Co., Midland, Mich., presided on the second day of the meeting. So much for the course, its sponsors, and its organization. What of the lecturers, and what did they say?

Stream Standards

L. L. Hedgepeth took "A CRITICAL LOOK AT STREAM STANDARDS." Mr. Hedgepeth was formerly Executive Secretary, State Water Control Board, Richmond, Va., and is at present consultant on waste disposal to the American Cyanamid Co., Boundbrook, N.J. It was Mr. Hedgepeth who said that "stream standards don't mean much, and are hard to apply in the field." It was he, too, who expressed the opinion that the approach to stream pollution abatement must be flexible and will fail if rigid standards are applied. The weakness of stream standards lies in the fact that methods of measurement are inadequate and correction of causes of pollution are not yet known in many instances. "You can't legislate against pollution when you don't know how to treat a waste."

Committee

J. E. Cooper
San. Engr.
Ford Motor Co.
Dearborn, Mich.

A. Habermehl
Chemist
Sew. Treat. Wks.
Detroit, Mich.

Mr. Hedgepeth believes firmly that stream pollution should be brought under control but he advocates tackling each problem individually, without trying to make every situation fit into a set pattern as would be the case where definite standards are set. Any program of waste abatement must be based on sound good will, tact, and a knowledge of the problems involved. To accomplish this program it is necessary to bring the technical men from industry into stream councils. If a program is technically impossible, it can be talked to death. It is much better to set a goal and work towards it rather than to set a standard impossible of attainment. Even the courts will not sustain an order to abate pollution if it is technically impossible to meet the requirements or if the economics make it unfeasible.

In the second part of his lecture, Mr. Hedgepeth cited several examples of how the problem had been attacked in Virginia in reference to four specific industries. He also discussed how this approach had worked effectively in the Shenandoah Valley.

In answer to questions, Mr. Hedgepeth said that ponds were successful

for fly ash handling, that permits may be revoked if an industry doesn't use known methods for waste treatment, and that his idea is that stream control boards should ask for flexible objectives (depending on stream use and abuse), not rigid standards, and that there should be no effluent standards. This idea is contrary to the approach taken by a number of states, and brought forth some spirited discussion, which had to be cut short because of limited time.

Acquisition of Data

"Acquisition of Pertinent Data in Relation to Stream Sanitation" was the topic presented by H. W. Streeter, San. Engr. Director (Retired), Environmental Health Laboratory, Cincinnati, Ohio. Pointing out that, in general, the highest use of a stream determines the objective in sanitation, Mr. Streeter said that specific requirements for the data were dependent on what that objective was.

These specific requirements consider the source of pollution, stream flow data, and stream quality. When studying sources of pollution the following data are considered pertinent: physiography or geology of the stream basin, climatic conditions, land conditions and uses, character of stream, rainfall and runoff, and underground water resources.

Other data collected include information on population (character, density, and trends), type of sewer system, composition and quantity of sewage, type, flow, and concentration of industrial wastes.

Under stream flow data, Mr. Streeter said that necessary information includes maximum, minimum and average flow in both typical and dry years. Frequency of high and low flows should also be ascertained.

Stream quality data are also pertinent. These data include information obtained by sampling and analysis of the stream at strategic points. The analytical data will include physical data, chemical analysis, presence of toxic substances, bacterial content, and biological information.

In the second portion of his lecture, Mr. Streeter discussed the mechanics of the collection of data with particular emphasis on sampling and the use of small field parties, and trailer laboratories.

Evaluation of Data

C. J. Velz, Head, Civil Engineering Dept. and Prof. of San. Engineering, Manhattan College, New York, N.Y., presented an outstanding lecture on "Evaluation of Analytical Data in Relation to Stream Sanitation."

Saying that the gap between what we know and what we apply is too great, Prof. Velz showed that the statistical method of analysis is a tool which will narrow that gap. Statistical analysis has as its basis the law of probability, and the simple explanation of why and how the law of probability works was the starting point for Prof. Velz's lecture.

By using the example of coin tossing, Prof. Velz established the definition of the law of probability and showed that numerical probability is expressed as a ratio from zero to one (or as a percentage from 1 to 100 per cent), where zero represents impossibility and one represents certainty. The importance of deviation

Committee
D. M. Pierce
San. Engr.
State H'lth Dept.
Lansing, Mich.

Lecturer
L. L. Hedgepeth
Cons. Engr.
Amer. Cyanamid Co.
Bound Brook, N.J.

from the mean, and the definition of the standard deviation were brought out.

Within plus or minus three times the standard deviation from the mean lies the range of practical certainty; that is, 99.73 per cent of all results will fall in that range.

In evaluating data, it becomes necessary to arrive at the most probable value, or the median—that value which is exceeded by half the values and below which lie the other half of the values. The "mode" is that value which is most frequently occurring. With these definitions in mind, and an explanation of the probability curve to show that it measures the variability of the data or the deviation from the mean, Prof. Velz stated that the use of the common arithmetic mean is too often a dangerous figure and will lead to improper evaluation of what the data really mean.

By use of normal probability graph paper, and by arranging a series of data in order of magnitude, plus plotting of these data according to a simple formula, it is possible to obtain graphically the mean value of any series of data, as, for example, ppm. of suspended solids or B.O.D., etc. By increasing the number of tests made, i.e. the number of datum points obtained for plotting, it is possible to control the deviation from the mean. The greater the number of tests, the smaller the deviation, and, therefore, the greater the certainty that the variation from the true mean will be limited. Prof. Velz highly recommends that this method of determining true mean values of a series of data be used rather than the simple arithmetical mean, or even the determination of the median value.

When it comes to the determination of Most Probable Numbers (M.P.N.) of coliform bacteria, Prof. Velz says "the M.P.N. is not a result; it is only a means to obtain a result." Actually the probability of the M.P.N. being correct is of low order. Prof. Velz prefers the expression, "True Mean Density," which is, as it implies, the determination of the actual concentration of bacterial organisms present in the water or sewage-laden stream. The Most Probable Number is not fixed, but will vary with the technic of the procedure used. Multiple portions in a single dilution will give one result; multiple portions in decimal dilutions will give different results, and the more portions and more dilutions employed the greater the number of results obtained.

By means of logarithmic probability paper it is possible to plot M.P.N. results and to obtain the True Mean Density. For this purpose, Prof. Velz has worked out proper plotting technic when using multiple portions in decimal dilutions. The slope of the curve will show how many portions have been used. If the slope for a three-portion set of results does not fall parallel to the standard slope, then the graph will show that the True Mean Density was changing during the time of sampling, or, in the words of Prof. Velz, "quality of the water was not constant." The variation from that standard slope will indicate the trend of change during sampling, and to some extent the degree of change, but the degree is only one of kind, not one of amplitude.

Prof. Velz has also worked out a procedure for the determination of the bacterial quality of water by using multiple portions in a single dilution, but time did not permit a complete exposition of this technic.

In the discussion of the lecture, and with particular reference to "Standard Methods" Prof. Velz said that insofar as knowledge is available the technics given in "Standard Methods for Water Analysis" are correct, but that we had never used the data obtained properly. In short, we had been incorrectly evaluating the data. For

future editions of "Standard Methods" he recommends that in reporting data the 95 per cent upper limit be included. That is the value below which it is known that the data or analytical result will occur 95 per cent of the time. It would seem from the interest aroused in this lecture that the use of statistical methods of analysis for evaluating analytical data is to become a definite and important factor in sanitary engineering data.

Biological Indicators

"THE USE OF BIOLOGICAL INDICATORS IN DETERMINATION OF STREAM POLLUTION" has its place in sanitary engineering according to James B. Lackey, Editor, Blakiston Co., Textbook Publishers, Philadelphia, Penna. Dr. Lackey knows

Lecturers

H. W. Streeter
San. Eng. Dir. (Ret.)
U.S.P.H.S.
Cincinnati, Ohio

C. J. Velz
Hd. Civ. Engrg.
Manhatten College
New York, N.Y.

whereof he speaks, for he was a long-time biologist with the U.S. Public Health Service.

In choosing biological indicators of pollution, Dr. Lackey said one must look for an organism that will live in a niche of conditions to the exclusion of all other organisms. Organisms that will live anywhere and under any conditions of stream are of no value. What is wanted is an unusual organism that will grow in abundance in pollution, and be absent when pollution is absent.

Inasmuch as there is practically no stream in this country that is free from pollution, the use of biological indicators should prove of considerable help and interest to those concerned with the problem. Before studying such indicators, however, it seems well to review the categories of pollution, which may be set up as follows: debris, directly toxic organics, inorganic toxic substances, and miscellaneous substances. Debris includes mud, coal dust, asbestos waste, and fibrous materials which may cover the bottoms and smother the organisms. While actually non-toxic, these materials may smother bottom growths and thus break up the aquatic life cycle necessary to maintain fish life. The truly toxic substances are more obvious, such as phenols, cyanides, chromium, lead, hydrogen sulfide, etc. "Anything which indirectly changes a stream in a short time is a pollutant." Thus substances which have no effect on the B.O.D. or the D.O. of a stream may still be polluting substances that should be removed.

The most commonly known biological indicator is the coliform group of bacteria, but Dr. Lackey pointed out that there is some doubt that coliform bacteria are always absent when pollution is absent, which is one of the four criteria for a good indicator organism. Another example commonly used to indicate pollution is *Sphearotilus natans*, which grows well in sewage pollution where the oxygen concentration is low. It will grow in paper mill wastes with the exception of Kraft process wastes, but it has certain limitations as an indicator organism.

This group of micro- to macroscopic organisms is called the *Protista* and included bacteria as well as some protozoa and algae. Some of these organisms, as for example, certain flagellates, will live in oxygen-free water. These are found mainly in sludge banks. Then there are the ciliates which will live in the absence of oxygen, and whose presence usually indicates heavy organic pollution. Certain plankton are good indicators but they do not occur everywhere, while the lower forms of *Protista* do. It is not wise to try to learn all of the types of these organisms, but to become acquainted with certain types that can be easily recognized and are known for their relation to pollution.

Dr. Lackey said that the best indicators are those that are present when others are absent and that are constant in appearance in the presence of pollution. He prefers certain ciliates and flagellates, a number of which he showed by means of slides. While there is no specific organism that will act as an indicator of organic pollution as a whole, there are a few that are specific for specific wastes. In this connection Dr. Lackey discussed sewage, distillery wastes, sulfur wastes, coal mining, etc. Because of complexity of studying biological indicators, Dr. Lackey said that such study and use of these organisms should be assigned to a biologist. It is too specific for the sanitary engineer to undertake as a part of his work.

Bacteriology

"THE BACTERIOLOGY OF STREAM POLLUTION" was the lecture topic presented by W. L. Mallman, Prof. of Bacteriology and Public Health, Michigan State College, East Lansing, Mich.

Prof. Mallman said that what was needed in the study of the bacteriology of streams was to find an organism which indicated when a water is safe or unsafe. The coliform group will not do this because they may often be found in the absence of pollution.

Most industrial wastes are of no interest or public health significance from the standpoint of being disease-producing. Domestic sewage remains as the source of most of these diseases. Most of these diseases are acquired only by ingestion of polluted water, although some diseases are acquired through the skin.

Prof. Mallman discussed the various *Salmonella* bacteria, the *Shigella*,

Lecturers

J. B. Lackey
Editor
Blakiston Co.
Phila. Penna.

W. L. Mallman
Prof. Bact.
Mich. State Coll.
E. Lansing, Mich.

the *Vibrio cholera*, *Endamoeba hystolytica*, and the viruses and their relation to water-borne diseases.

Citing data from the Los Angeles water supply, Prof. Mallman spoke at length on the applicability of coliform bacteria as indicators. These samples from an unpolluted supply actually showed the presence of coliform bacteria. It has also been shown that non-fecal aerogenes bacteria are found in waters immediately below a sewage outfall. Thus the coliform group loses some of its value as an indicator organism.

Prof. Mallman also presented data on beach studies to show how various organisms die off in time in polluted waters. Present studies are being directed to develop bacteriological media which will be specific for indicator organisms. One of the organisms now being studied is a streptococcus, which has been investigated before without much success. Dr. Mallman is encouraged as to the possibility of using this organism.

Fundamentals of Chlorination

The last two papers were devoted to "CHLORINATION OF SEWAGE AND WASTES IN RELATION TO STREAM SANITATION." Part I on "FUNDA-

MENTALS OF CHLORINATION," was presented by Edward W. Moore, Assoc. Prof. of San. Engr., Harvard University, Cambridge, Mass.

Prof. Moore reviewed the three objectives of chlorination:—to eliminate pathogens, to reduce B.O.D., and to treat wastes. Chlorine compounds available for these purposes were also discussed, but the principal part of Prof. Moore's lecture was devoted to an explanation of the theory of disinfection and the form of chlorine which is most effective in accomplishing this disinfection. According to the work done at Harvard, it is the HOCl molecule which is most effective, not the ionized hypochlorite ion. The extent of ionization depends on the pH of the water. The effectiveness of chloramines and the whys and wherefores thereof were also a part of Prof. Moore's presentation. The effectiveness of HOCl is about 80 times that of chloramines.

The applicability of the O.T.A. test to determine true chlorine residuals was presented as being something less than perfection, but it is still the best method available.

In the chlorination of sewage, the age of the sewage is important both as to the amount of chlorine required and the disinfection and B.O.D. reduction accomplished. Aeration of sewage is also an important factor in this relationship. In general, it may be expected that the B.O.D. of sewage will be reduced about 2 ppm. for each part of chlorine added to the sewage.

Practical Aspects of Chlorination

Part II of the session devoted to sewage chlorination was a lecture on "PRACTICAL ASPECTS OF CHLORINATION" presented by L. F. Warrick, State San. Engr., Bureau of Sanitary Engineering, State Department of Health, Madison, Wisc.

According to Mr. Warrick, the primary role assigned to chlorination in sewage treatment is disinfection, but chlorine plays additional roles: odor control, grease removal, better clarification, reduction of B.O.D., control of filter flies, and various other benefits. From the point of view of stream sanitation, chlorination of sewage reduces bacterial contamination of waters used for public water supplies.

Important in the chlorination of sewage is the residual maintained and the contact period. Different states have different standards and some of these standards were discussed by Mr. Warrick, who mentioned the work of Eliassen on the statistical approach to sewage chlorination to obtain certain bacterial reduction results. It is of pertinent interest that the important thing is not the per cent reduction of bacteria but the number of residual bacteria present in the chlorinated effluent.

Chlorination

E. W. Moore
Prof. San. Engr.
Harvard Univ.
Cambridge, Mass.

L. F. Warrick
Ch. San. Engr.
St. Bd. H'lth
Madison, Wis.

Quantities of chlorine required vary according to the composition of the sewage as well as its age and the presence of hydrogen sulfide. Mr. Warrick quoted the work of Symons, et al on the per capita chlorine demand (0.005 lb. per day) and the effects of industrial waste on this demand. In Buffalo, N.Y., the industrial waste present doubles the per capita daily demand.

Regulation of dosage has generally been manually, and in larger plants this adjustment has been made according to hourly or less frequent determinations of chlorine demand. Now there are available two new methods of chlorine dosage control. These are (1) programmed step-by-step chlorination and (2) potential control.

Among the uses of chlorine, Mr. Warrick discussed odor control, reduction of B.O.D., and aids to clarification. In addition, he went into more or less detail on the use of chlorine to control bulking of activated sludge, control of sludge foaming, supernatant control, etc.

Chlorine is also being used to treat industrial wastes, and recent processes developed include the treatment of wool scouring wastes, treatment of phenol wastes, and treatment of tannery and slaughterhouse wastes.

Mr. Warrick concluded that it is apparent that chlorine is especially helpful in bettering operating results at overloaded plants where it has been employed in oxidizing, sterilizing, controlling odors, retarding decomposition, and coagulating protein substances. With new methods for measuring sub-residuals and better control of chlorine dosage, it is evident from successes to date that an even greater and broader horizon exists for chlorination in sewage and waste treatment.

New York's Governor Signs Pollution Abatement Bill

On April 20 Governor Dewey of New York State signed into law an act which sets up a board to prevent further pollution of the waters of that state. With this signing, the country's most populous state joins the growing number of states which have created stream control boards for the purpose of abating pollution of the streams, lakes, and other waters of the U.S.

The bill was the result of three years study by a special legislative committee headed by Assemblyman Ostertag, who described the provisions of the bill in an article in *Water & Sewage Works* in April. In signing the bill, Gov. Dewey said, "It is my firm conviction that this bill, which unanimously passed both houses of the Legislature, will provide the necessary legal and administrative machinery to protect our rivers, lakes and coastal waters against progressive degradation."

Under the new law a board consisting of the Commissioners of Health, Conservation, Agriculture and Markets, Commerce, and the Supt. of Public Works, has certain definite duties. The board is to classify the waters of the state as to quality and purity; it is to make or modify orders requiring discontinuance of the discharge of sewage and wastes; it is to encourage formulation of plans by cooperative groups of industry, municipalities, etc., toward pollution abatement; and it is to prepare and develop a comprehensive plan for the abatement and prevention of pollution.

Working as technical advisors to the legislative committee which prepared the bill were Earl Devendorf, Director of the Bur. of Environmental Sanitation, and Morris Cohn, Consultant to the Committee.

U.S. Pipe Cuts Price on C.I. Pipe

The United States Pipe and Foundry Co. has announced two price reductions totalling $11 per net ton for cast iron pipe. On April 25 the price was reduced $7 per net ton. Within a week, on May 1, a further price reduction of $4 per net ton was announced. The second price reduction was occasioned by a reduction in pig iron prices.

With the price of cast iron pipe on the decline, it would appear that water and sewage works may find it easier to obtain the C.I. pipe to fill their needs.

A STANDPIPE BITES THE DUST

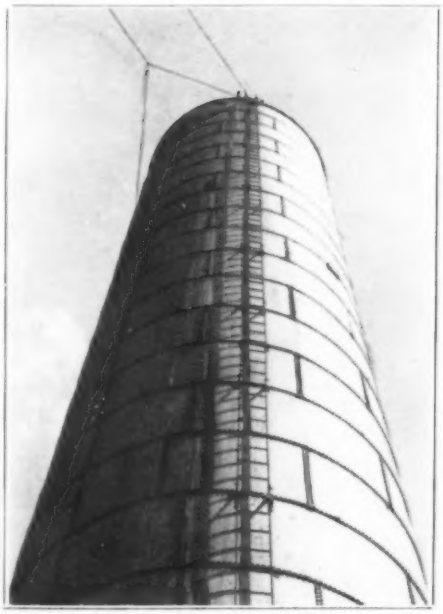
Felled in the Same Manner as Cutting Down a Tree

by

W. R. WISE
Manager-Engineer
PUBLIC UTILITIES
NEWBERRY, S.C.

THE DEPT. of Water, Electricity & Sewerage of Newberry, S.C., was faced with the problem of removing an old standpipe 120 ft. high and 20 ft. in diameter. This article reveals the simple and effective method employed in felling and salvaging the unit which yielded 55 tons of scrap a year ago when scrap iron was worth considerably more than it is today.

The old standpipe was installed in 1897 by the R. D. Cole Co. of Newnan, Ga., and remained in continuous service until December, 1947, when it developed a leak which we attempted to plug with a cypress plug. We dropped the water head and plugged it, but when the tank was refilled there were 18 leaks at different points. The leaks would not "take up" so the tank was emptied and an inspection was made of the interior. Most of the rivet heads were gone and considerable metal was missing from the plates.



Upper Portion of Standpipe
Showing pull lines from top to 25-ton power winch.

We then decided to remove this tank and sell it for scrap. However, we could not locate sufficient past records that would enable us to determine the type metal the tank was made of. Samples were chipped off and forwarded to the R. D. Cole Co. who, upon analyzing the metal, determined it was a mild steel plate with about the same physical and chemical properties as ASTM-A-7.

We then offered this tank for sale to various scrap dealers under two optional conditions; (1) bid on tank in place (2) bid on tank on the ground. If the bidder was to remove the tank, he must post surety and liability bonds in order to protect the City from any damages caused in dismantling it.

How the Unit Was Felled

The tank was removed by three men using a cutting torch and a 25-ton winch.

SCRAP—55 Tons of It

First, a large chip was cut from the tank at the base on the side on which it was desired to have the tank fall. Cables from the power winch were attached to top of tank and cutting torches were applied to the base of the tank, starting at the back side and cutting a sloping cut toward the chip. The picture on the front cover shows the tank on its way to the ground. It is *not* leaning on the tree limb as it would appear.

Work was begun at 8 A.M. and by 5 P.M. the tank had started leaning in the proper direction as desired. By 5:30 P.M. the tank was on the ground exactly where it was desired. Very little vibration was experienced as the tank struck the ground. A school house and several residences were approximately 250 feet from the base of the tank. The tank completely collapsed when it struck the ground except for 40 ft. of the bottom plates.

Standpipe on Ground

Showing how slanting cut was made in rear of base with cutting torches.

The scrap dealer then cut the tank into smaller pieces for shipment. This tank weighed out at 55 tons and we were informed that it had weighed approximately 60 tons when installed 51 years ago.

ARKANSAS WATER AND SEWAGE CONFERENCE*

The Eighteenth Annual Arkansas Water and Sewage Conference topped all records for size and enthusiasm. Meeting in the Municipal Auditorium in Little Rock, on April 11-13, 160 persons held three school sessions of three hours each on three subjects: (1) Water Purification, (2) Meters, (3) Distribution Systems. W. A. Mayhan, Supt. of Filtration, Little Rock Municipal Water Works, was Program Chairman.

A growing interest in the Voluntary Licensing Plan was shown by the report that more than fifty have taken examinations within the year. Additional recognition was given to District Conferences, held monthly within the state.

At the business meeting the Conference voted approval of efforts made to broaden coverage of Social Security to include water and sewage employees. Deep regret was expressed at the passing of Egmont S. Smith and a pledge of support to the Memorial Scholarship Fund in his name given. Little Rock was chosen for the next meeting, the probable dates being April 10, 11, 12, 1950.

The following officers were elected:

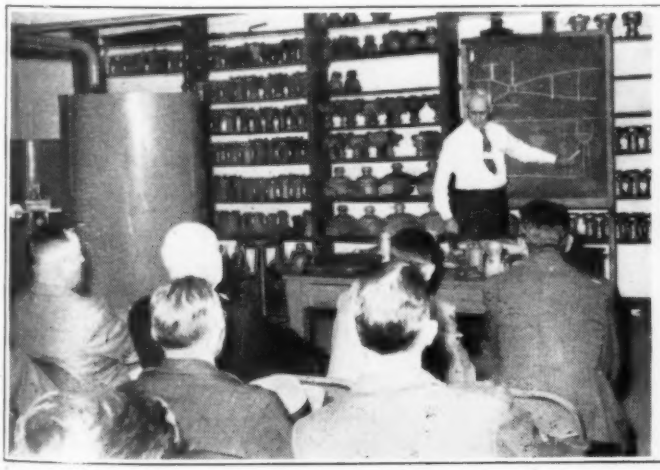
Chairman
Neal B. Tahyer, Jonesboro

Vice Chairman
Fay Peer, Van Buren

Secretary
Harrison Hale, Fayetteville

The Sewage Works Section had a special luncheon honoring its third birthday. A membership of 48 was reported. Ben W. Dees, Little Rock, was elected to succeed F. L. McDonald as Director of the Federation for the term beginning October, 1949.

*Report prepared from notes by Harrison Hale, Secy., Fayetteville, Ark. Classroom photos by F. E. Wilson, Chem., Ark State Bd. of Health.



Two Classes In Session

Dr. W. A. Bandy, Texas A. & M. College, lecturing. *C. H. French, Engr., Ark. State Bd. of Health, lecturer.*

A.S.W.W.A.'S SPRING MEETING

DESPITE Arizona's unheralded April snowstorm, 133 members and guests came to Prescott for the Spring Conference of the Arizona Sewage & Water Works Association, April 1-3.

"Removal of Fluorides from Water Supplies" by George Swem, of The Permutit Co., constituted the opening paper, which outlined three methods of defluoridation—the magnesia precipitation process, alum coagulation process and the "Fluo-Karb" process. The latter involves use of contact-absorption beds of a phosphate type of granular material processed from crushed bone. Professor H. V. Smith of the Univ. of Arizona, one of the pioneers in the field of research on this problem, described briefly the world's largest phosphatic absorbent plant at Climax, Colo., where the fluoride content of the water is reduced from 23.0 ppm. to less than 1.0 ppm. fluorine.

The remainder of the first session was devoted to a discussion of public relations problems in both the sewage and waterworks field. W. H. Wisely, Executive Secretary of the Sewage Works Federation, related some personal experiences as a plant operator. Both he and John C. Luthin, Water Superintendent of Santa Cruz, Calif., stressed the importance of maintaining good public relations with the individual customer as well as with the public as a whole. The use of press, radio, display and other advertising media were outlined.

At the luncheon session reports from the F.S.W.A. and A.W.W.A. were featured. A. W. Miller, A.W.W.A. Director, reported the progress of the Association during the past year and gave a brief résumé of the Board meeting held in Chicago in January. W. H. Wisely discussed the recent growth of the Federation and announced that the *Sewage Works Journal* is to be issued on a monthly basis, starting with the January 1950 issue, necessitating some increase in dues.

Walter Harford's informal discussion of concrete pipe followed the luncheon meeting. It dealt with the manufacture and use of different types of pipe and joints for pressure concrete pipe.

"Septic Tank Design and Performance" by Harvey F. Ludwig, Los Angeles consulting engineer, highlighted studies being made of septic tank performance, as related to design, and discussed a design which departs somewhat from the conventional design long in use. M. E. Devine, Tucson Water Department, related successful efforts in **"Repair of Reservoirs,"** in which he had effectively and economically repaired leaky concrete reservoirs by gunniting the entire inside. He also reported on the use of granular bentonite clay swept into the cracks and bentonite sealing protected with strips of waterproofed canvas in tar base plastic over the bentonite filled cracks. The Friday session was concluded with a panel discussion led by Director A. W. Miller of such topics as in-service training of water and sewage works personnel, the value of A.W.W.A. specifications, the proper use of A.W.W.A. public relations material and the value of short schools for operators.

Byrl D. Phelps, San Diego consulting engineer, was toastmaster at the Friday night dinner where a color portrayal of the proposed Central Arizona Irrigation Project was featured.

At the business meeting the following officers were elected. President, A. Anton Frederickson, Pima; First Vice-President, Geo. W. Marx, Phoenix; Second Vice-President, John Hoover, Mesa; Secretary, Mrs. Helen Rotthaus, Phoenix. Section Directors: Clark Webb, Dario Travaini, Stuart Henderson, Guy Rhoads, Harold Yost, John Rauscher, A. W. Miller.

A resolution adopted requested the Arizona State Department of Health to conduct a survey to determine the source of nitrates in well water in the Salt River Valley.

"Horizontal and Vertical Pumps and Their Applications," by T. R. Mackay, Chief Engineer, Fairbanks-Morse Co., comprised a discussion of radial and centrifugal pumps. Mr. Mackay pointed out that combinations of these can be selected by means of a chart which reveals quantities and heads.

Fred G. Nelson, The Dorr Co., presented **"Some Thoughts on Sludge Digestion,"** and the morning session was concluded by a history and description of the Prescott water supply, presented by Cecil Overstreet, Prescott City Engineer, and Stuart P. Henderson, Water Superintendent. The development of the Prescott supply was traced from 1864 when it consisted of one well and a hand pump, to the present newly-developed source at Del Rio, 19 miles north of Prescott.

Rev. Charles F. Parker, speaker at the Saturday luncheon, took as his "text" the A.W.W.A. slogan, **"Silent Service is Not Enough,"** and stressed the fact that the community should be made more aware of the services rendered by the water works industry. He lauded the continuing program of expansion and improvement in the industry and urged that a good nation-wide public relations program be utilized by all water utilities. The good Reverend threw this one out—"Water works publicity should be as strong as chlorine but as palatable as maple syrup."

Under the leadership of Guy Rhoads and John Hoover, the operators met in closed session Saturday afternoon to discuss mutual problems of operation. This feature, known as the "Roundup," was participated in by thirty operators.

In a parallel session Richard Bennett, Engineer, City of Phoenix, discussed **"Developments in Sewer Design,"** and John C. Luthin led a panel discussion on **"Cost Engineering in Water Works Practice,"** pointing out that cost-engineering acts as a co-ordinating tie between planning, estimating, cost accounting, general accounting and cost reporting. A. M. Rawn, Chief Engineer, Sanitation Districts of Los Angeles County, spoke on **"Recent Sewage Disposal Developments"** in which he outlined a process of checking septicization of sewage in force mains by injections of compressed air in place of disinfectants.

Previous to the closing dinner registrants were tendered a cocktail party by the manufacturers' representatives, who also provided an evening of dancing following the dinner.

On Sunday morning the Conference concluded with a tour of the Prescott water supply at Del Rio.

The Fall Conference of the A.S.W.W.A. will be held in Yuma, November 11-12-13, at the San Carlos Hotel.

A.S.W.W.A. Officers—Old and New

(1) F.S.W.A. Director, Harold W. Yost, (2) Section Director, R. M. Cushing; (3) Vice-Pres., John Hoover; (4) Secy.-Treas., Helen Rotthaus; (5) Retiring President, John Rausher; (6) New President, Anton Frederickson; (7) A.W.W.A. Director, Alden Miller. (1st Vice-Pres., Geo. W. Marx, not present.)

AIR CONDITIONING COUNTER IRRITANT

by
W. R. LaDUE
Supt. and Chief Engr.,
BUREAU OF WATER & SEWERAGE
AKRON, OHIO

THE CITY of Akron, through engineering foresight, is blessed with an adequate supply of water and adequate main capacity in the industrial and business areas of the city. In consequence, until the last few years little attention has been paid to the installation of air conditioning equipment using water as a cooling medium, the same being permitted as required without any special regulations limiting the use of water.

Installations here lagged behind those in the warmer areas of the temperate zone. Akron's weather, being tempered by Lake Erie, has usually two months of weather desirable for using air conditioning. The normal mean temperatures for the months of June through September have been as follows:

	High	Low	Mean
June	79.0	58.0	68.5
July	83.6	61.7	72.6
Aug.	81.4	60.6	71.0
Sept.	74.5	54.1	64.3

Temperatures usually reach the 90's for several warm periods, and into the high 90's for at least a portion of one week. It can, therefore, be seen that locally air conditioning basically was not a primary need, but more of a luxury.

Naturally, as some retail establishments installed air conditioning for customer comfort, as an attraction for buyers, competition forced similar installations. Consequently, during the past few years air conditioning units have been installed at an accelerated rate, with installations in most downtown retail stores and many offices, factories and laboratories. The majority of the recent installations are of the small package type in units of 5 hp. (or tons), or multiples thereof. Industrial or large installations, having had a complete engineering study embracing cost of operation and cooling water (usually involving incorporation of water-saving devices), cause little difficulty in administration. On the other hand, small package units were sold much like other household electrical devices, such as refrigerators, electric stoves, etc., with little or no thought or explanation given to water requirements, other costs of operation and maintenance, or physical requirements to satisfactorily operate the units.

The Author

"Passing the Buck"

Subsequent to the installation of many of these units, the Akron Bureau of Water immediately began to feel the reaction, both on an operating and cost basis. Either the units did not have enough water of the temperature of the Akron supply to satisfactorily operate, or else they used all the available water during the period of the operation and the balance of the house fixtures were without adequate water flow during hours of peak water demand. Installers and servicemen, unfamiliar with hydraulics, attempted to charge the failure of efficient performance, or the cost of operation on the water utility. The stories usually received were "The maintenance man says we are not getting enough water into the building," and "The salesman says it is impossible to use that much water in an air conditioning unit." After several customer contacts that were jeopardizing good relations, it was decided that something should be done about this newly created problem.

The Situation Is Studied

An investigation revealed that the bulk of the small package units were being sold by one organization in the city. An appointment was made with the engineers of this company at which appointment the Water Bureau was represented by an associate engineer, an assistant engineer in charge of sizing services and meters, and the office manager. The conference developed the following:

(1) An explanation of the type and operation of the automatic valves controlling the flow of cooling water was given. The setting, adjustment, and use of these valves was demonstrated, and the failure of operation of these automatic valves which causes large water consumption was discussed.

(2) The radiation or cooling devices, together with the amount of heat that should be dissipated by the flow of water, the incrustation, clogging, and requisite cleaning and servicing were reviewed thoroughly.

(3) Various types of packaged air conditioning units were inspected. Specifications for water capacity, probable economic length of life, and basis for unit size determination, were analyzed. It was discovered in many instances that the units installed upon the insistence of the customer are undersized and operate continuously once they are turned on.

(4) Heat load conditions were considered, and it was found that in a normal business more heat is emitted as body radiation, or from lighting and other fixtures (such as coffee urns and hot plates), than infiltrates through the walls of the building, including windows and doors used for ingress and egress.

(5) Water pressures, service sizing and interior piping were discussed in order to inform the air conditioning installer of existing conditions and their effect on the performance of air conditioning equipment.

Results Beneficial to All Concerned

The conferences were beneficial, since the participants had a better understanding of existing conditions and the requirements for successful operation of water cooled air conditioning units throughout the city. The air conditioning engineers received a promise of full cooperation in ascertaining if adequate water was available, and they in turn promised to include water requirements in the study of each installation. We both benefited by realizing that the errors or shortcomings of one could not be passed to the other.

In order to supplement the general information obtained, five locations were selected for the independent measurement of the water consumed by various makes of air conditioning equipment installed in varying types of establishments. Where necessary, meters were cut in on the intake line to the unit to measure the flow of

water required to cool the equipment, and thereby hangs a tale:

One of the units was not operating satisfactorily, and the serviceman insisted that the unit was not obtaining adequate water and that the ⅝ in. meter in the line was restricting the flow, and that he could do nothing until the meter was removed. Two visits by our engineers each time satisfied the owner that the trouble was elsewhere, but each time the serviceman was missed. It finally took a third visit, with the service man detained until the engineer arrived. No end of discussion would satisfy him that the meter had adequate capacity and would pass the required amount of water. It was necessary to disconnect the discharge side of the meter and actually show him how much water the meter would pass. Thus, an uninformed serviceman was forcefully converted.

Water Requirement Survey

The measurement of water requirements for the various types of establishments, and operated under the listed conditions, are presented in the accompanying table.

Survey of Air-Conditioning Units in Various Establishments

Type of Business	Hours Open	Approximate Size	Approx. No. of Employees	Heat Producing Equipment	Inside Temp.
(a) Cafe	10:00 A.M. to 2:00 A.M.	One Floor, (40′ x 100′)	16	Lights, Coffee Maker	70°-75°
(b) Bar	10:00 A.M. to 2:00 A.M.	One Floor, (40′ x 100′)	12	Lights, Coffee Maker	70°-75°
(c) Restaurant	9:00 A.M. to 9:00 P.M.	20′ x 100′	9	Lights, Toaster, Coffee Maker	70°-75°
(d) Shoe Store	10:00 A.M. to 5:30 P.M.	20′ x 50′	3	Lights	70°-75°
(e) Clothing Co.	10:00 A.M. to 5:30 P.M.	One Floor, (40′ x 120′)	16	Lights	70°-75°

The establishments had air conditioning units manufactured by three different companies. The water use statistics for the various installations appear in a second tabulation.

Two of the above installations had meters cut in on the intake lines. These two customers had vociferously objected to the size of the water bill. To their credit, these customers willingly cooperated in the study of water consumption for their units. Although questioning could not reveal any reason for the abnormal consumption of water, observed operating conditions revealed that one unit was undersized and had to be kept on twenty-four hours a day. In the other, since much expensive candy was stored, the unit was operated twenty-four hours every day to maintain candy quality. As previously stated, these conditions were not admitted in the discussion of the previous bills, but were discovered by our employees studying the problem, and unintentionally revealed by employees of the customer. Thus, there is *always a reason* for a high water consumption *if it can be found*. These disclosures confirmed the soundness of our policy of making no adjustments in matters of this nature.

Developing a Complete Record

In order to have a complete record of air conditioning installations for further engineering studies and improving public relations, letters were dispatched to all air conditioning sales companies listed in the telephone directory, requesting locations of installed units. The response from the first letters was very disappointing. A second letter was necessary, giving a reason for the requested information and suggesting regulation of installations if the information was not forthcoming. Complete cooperation was then secured. After receiving this list, notations were made of their existence on both the meter reader's sheet and the customer ledger and made a part of the engineering records. Records of larger installations, normally installed by out-of-town corporations, were inserted as reported by the meter readers, upon instructions to furnish this information. Our record is kept current through annual reports from the installing companies of all installations made during the preceding year.

Water Bureau personnel handling the public contacts were instructed as to the probable water use. Our basic rule is that the maximum probable use of water in an air conditioning unit, size 5 hp. (or tons) is one cubic foot per minute. Thus, if an undersized unit operates 24 hours per day, the maximum probable usage is 1,440 cubic feet per day. Using this as a basis of discussion, very little difficulty is incurred in explaining the bills. This figure is also very useful in connection with the computation of the make-up water required on a unit having a water tower or other economizing cooling and recirculating devices, as well as an evaporator unit, both of which are claimed to use only 10 to 15% of that required for a water-cooled unit.

Water Usage and Costs

Type of Business	Equipment Make	Equipment HP	Daily Av. (Cu. Ft.)	C.F. (HP)	Quar. Tot. (Cu. Ft.)	Air Cond. Only (Per Quarter) Gross	Net
(a) Cafe	X	5	243	49	21,870	$ 37.18	$ 32.81
(b) Bar	Y	10	927	93	83,430	117.79	109.36
(c) Restaurant	Y	5	565	115	50,850	74.26	68.61
(d) Shoe Store	Y	5	165	33	14,850	25.14	22.27
(e) Clothing Co.	Z	10	720	72	64,800	101.31	94.30

Our last year's experience reveals that our procedure was apparently correct. The number of complaints of inadequate supply of water for a unit was only a small fraction of the previous year. Discussions of high bills have materially decreased. Requests for advanced information and data from air conditioning installers have multiplied in number. Statements placing the blame for non-performance of a unit on the Water Bureau have virtually disappeared.

H. R. Wilke Assoc. Prof. San. Eng. Purdue

Announcement has been made of the appointment of Harvey R. Wilke as associate professor of sanitary engineering at Purdue University. Prof. Wilke's assignment includes teaching,

direction of research projects in the field of water treatment, and participation in extension work in the State of Indiana.

Prior to joining the staff of Purdue University, Mr. Wilke had been an engineer with the Division of Health of the State of Missouri for three years, and from April, 1941, to January, 1946, he had been assigned to water supply instructional duties with the Army Corps of Engineers at the Engineer School, Ft. Belvoir, Va.

Prof. Wilke holds a B.S. in Civil Engineering and M.S. in Sanitary Engineering from the Univ. of Missouri.

ALGAE CONTROL

Experiences and Practices at Danbury, Conn.

by
ELLIS A. TARLTON
City Chemist
DANBURY, CONN.

TWO MAIN systems of storage reservoirs, known as the West Lake and the Margerie Reservoir systems, supply Danbury through two similar 5 mgd. rapid sand filtration plants. They are about equal in size with a total storage capacity of about 3 billion gallons and each main reservoir is supplied from three auxiliary reservoirs by gravity flow and by pumping, and each serves about half of the city. The chemical and physical attributes, and general treatment problems of the two systems are quite different although both are, in general, soft, colored, surface waters.

The industrial demands of the city determine to a large extent our method of operation. Since our pure water storage is only about 20 per cent of the normal daily consumption, and the demand during the day exceeds our treatment rate by about a third, we must operate so that when our load comes on at 7:00 A.M., all filters are clean, and all clear wells full. As plant design makes necessary a complete shutdown of at least an hour's duration to backwash filters, filter runs must be at least ten hours, during which the filtration rate must not fall below a minimum of 1.6 gal. per sq. ft. of filter area per min.

The felting and dyeing processes of our major industries demand a water free of color, turbidity, iron, and aluminum, and with low pH and hardness, both held to a constant value.

A weak floc, induced by large algae concentrations, will pass appreciable amounts of these interfering substances through the filters. Daily "blooming" of algae in our shallow reservoirs cause the raw water pH to vary from 7.0 to 10.0 in a few hours. To insure safe operation and acceptable water quality we have set up minimum standards for raw, treated, and settled water at both our filtration plants, and control is merely a question of operating to remain within these limits.

Copper Sulfate Dosage

Copper sulfate, for algae control, is applied by hanging bags of the chemical over the sides of a motor boat, and pursuing a systematic course to give adequate distribution. This distribution is obtained by following the reservoir shore line as closely as possible for the first circuit and then making each succeeding circuit twenty-five to fifty feet within the previous one. We have been able to apply a maximum dose, in one day, of 4000 lb. by this method in warm weather, and about 2500 lb. in cold weather. We estimate dosages from the total volume of water actually in the reservoir at the time of treatment as computed from the original storage curves. Dosages range from 2 to 5 lb. per mil. gal. With each treatment of a given organism under similar conditions we attempt a lower unit dose.

The Author

We have never had a treatment be ineffective, although we have had to wait as long as ten to fourteen days for its full effect to be felt at West Lake. As our control keeps us well ahead of trouble, such a delay is not a cause for worry. Usually conditions clear up in one to two days at the Margerie Reservoir, and four to six days at West Lake.

Throughout the year we run weekly microscopic counts on the two main reservoirs with daily or every other day counts during the critical months of June to October. Only five organisms are counted at the West Lake Reservoir. While at the Margerie Reservoir all organisms are counted and a careful watch kept on the increase of any organisms existing in appreciable amounts. Examinations of the auxiliary reservoirs are made occasionally, particularly before it is proposed to discharge one into the main reservoir. Such records plotted on semi-log paper and interpreted in the light of past experience with the individual reservoir and other factors of present conditions and future plans take the guess work out of operations. By systematic biological examinations, we are usually ahead of any taste and odor trouble. Waiting until a slight taste is detected in the filtered water makes it certain we shall experience one or two weeks of real taste and odor. This, of course, applies particularly to the West Lake Supply.

MARGERIE SYSTEM

The Margerie System consists of the main storage Margerie Reservoir which is on the site of an old swamp and contains large shallow areas with the deepest point, at the intake, of only twenty feet, and into which the large East Lake Reservoir feeds by gravity. East Lake has no shallow or swampy areas and the algae record is good. Normally the entire output of this East Lake Reservoir is used first. The so-called King Street Diversion poses another problem as it has no storage but is a large swampy catchment area, capable of seeding the main reservoir. Even in very dry weather this has a one to two million gallon per day yield. Unless we have an emergency it must be allowed to run to waste during the summer months. It is an ideal location for continuous copper sulfate application and we hope that we will have the man power to so treat it this coming season and maintain its flow into the Margerie Reservoir the year round. The third auxiliary supply is the small Padanaram Reservoir which has little storage but a large catchment area and a high yield during wet weather. Since cost of pumping is involved this is only used when all supplies are low, following a prolonged dry spell.

Margerie Filtration Plant

The Margerie Filtration Plant that treats all the water delivered by this system uses alum coagulation, has an effective battery of spray aerators, rapid mix flocculators, well baffled twin settling basins with a minimum detention period of 7.5 hours, and six filter units, all equipped with surface wash equipment and with two capped with Anthrafilt. Lime and Calgon are

*This paper, presented before the New England Water Works Assn., March 17, 1949, is here published by permission of the Association.

used for corrosion control at a delivered water pH of 8.0. Post chlorine and ammonia are used for sterilization, while provisions for prechlorination are provided. A twin mobile feeder unit has been a help in experimental feeding of various types of weighting agents, acid, ammonia, and silica at various points.

The water has high color and turbidity, tremendous algae growths and about twice the hardness and mineralization of the West Lake supply. It is not too corrosive. The main problems in operation are to provide a water that can be pretreated readily so that no undue load is thrown on the filters, to keep the filters clean, and to keep odors down in the plant so that effective chlorination can be maintained without iodoform tastes.

Algae Control Practices

Since we are not bothered as much by taste and odor problems in the raw water at the Margerie Plant, we do not prechlorinate. Many of the tastes and odors readily filter out. Also, we have more equipment to attack the algae problem in the plant itself. Therefore, we can consider algae control from a different viewpoint here. That is, much of the time we can let growths continue that would swamp the facilities of the other plant. At the Margerie Plant we can take full advantage of modern equipment to achieve an economically balanced algae control program, while at the West Lake supply we must continue to operate as if we were delivering directly to the city without the benefit of a treatment plant. At the Margerie System, it is not economically justifiable to keep all algae growths in subjugation when it is possible to handle them easily and cheaply at the treatment plant, and deliver a clear tasteless water.

This is particularly desirable since the main Margerie Reservoir is difficult to copper with our primitive methods due to the shallow areas, the stone walls running at random, the type of labor employed, and the fact that a new growth is well started a few days after one is successfully killed. Therefore, our plan of attack at Margerie has been to study algae counts carefully, noting whether one or more than one type predominates, what percent of the total count each represents, and the rate of change from day to day of that type. As the algae growths increase, small daily adjustments in chemical feed, equipment, and operational methods keep pace with them to maintain our predetermined optimum conditions such as a maximum turbidity of 2.0 on the filters, a maximum pH of 6.7 in the treated water, minimum filter runs of 23 hours and minimum rates of flow of 70,000 gal. per ft. head loss per filter, and a minimum floc size in the last flocculator of 2.0 mm.

When we find that the increase in the cost of chemicals and power to maintain the above conditions will justify an expenditure for copper sulfate; or the floc is ceasing to break in clear particles in the flocculators, but is appearing in a greenish mist; or the pH cycle of the raw water which has been ranging from 7.0 to 9.0 or 10.0 and recovering daily holds its high peak through the second day, then we plan a copper sulfate treatment immediately. Such control will average less than one treatment a month from July through October, for by picking our spots in this manner we can deliver our killing blow at the last possible moment.

Floc Formation

Normally we obtain a large fragile floc particle quickly, without agitation. Although the designer included flocculator equipment, its inclusion is not economically justifiable inasmuch as it is not needed to build up a large floc particle. It is not used most of the time, and when used, often actually reduces the particle size. However, we use the flocculators with certain growths, particularly *Coelesphaerium*, *Anabaena*, and other free floaters, for we find that, while we get a smaller, poorer floc we get better quality settled water; that is, lower turbidity and color applied to the filters, which is, after all, what is wanted.

Jar tests are of little use since the floc forms so readily it is impossible to get results comparable to plant operation. It is only in times of trouble and winter operation, and in experimental work with coagulant aids using minimum alum dosages that it is possible to draw worthwhile conclusions.

Daily Bloom Effects

One of the most interesting features of the Margerie Reservoir is the pH cycle resulting from the daily "bloom" of algae growths in hot sunny weather using up the free and half-bound carbon dioxide in the process of photosynthesis. Normally a pH of about 7.0 will prevail for half a day when a gradual rise to below 8.0 will suddenly zoom to 9.0 or 10.0 as the growth reaches its highest point of logarithmic increase. This pH value holds for two to three hours, and drops off slowly as the supply of carbon dioxide released by the forces of decomposition exceeds the demand and again depresses the pH.

In the early days of plant operation nothing was known of the activity of these forces and the operators were continually puzzled by the sudden inexplicable shift to a poor quality settled water. During the high peak of the pH cycle there was insufficient alum to lower the pH to the optimum point of floc formation. If the algae growth is not checked the daily variations gradually cease and a continuous high pH is found. With certain types of algae it has been found possible to continue operating without reservoir treatment, as long as costs are not excessive and there is no danger of losing control of floc formation. Following successful killing of a predominant organism we will occasionally experience large growths of several types reaching proportions of 5,000 to 10,000 v.s.u. Such large coincidental growths have usually been easy to pretreat forming a fairly strong floc particle with moderate alum dosages.

We have found that while an increase of the alum coagulant is required to handle an increase in algae concentration the large dosages necessary at times of high pH are in large part merely for pH depression to the optimum range. Such lowering of the pH of the raw or settled water may also be achieved by bypassing the aerators and retaining in the treated water the carbon dioxide released by the alum application, or by treating directly with sulfuric acid. Fortunately, odor control by aeration is unimportant so the aerators are usually bypassed at the first sign of high pH until about one day after treatment. If left out of service, there would be a sudden increase in treated water acidity as soon as the first effects of the copper sulfate were felt which would necessitate an immediate increase in post lime treatment, and this sudden increase in hardness would interfere with the time schedules in the felting process in the hat factories. We are about to install continuous pH indicating equipment at four points in the plant to give continuous pH values of the raw water supply, water in the flocculators, applied water, and effluent. We also plan to install equipment for accurately feeding sulfuric acid to immediately counteract raw water changes and maintain an optimum pH in the treated water.

Although we understand trouble is met with in copper sulfate treatment at high pH values, we have not yet experienced any. We continually obtain good killing in one to two days and complete disappearance of the

organism in four to five days after having treated with 2 to 3 lb. per mil. gal. at a pH of 8.0 to 10.0.

Experimental Studies

Following our first year's experience with these high pH values we made plans for using during the next season a ferric sulfate coagulant which operates best at such a high pH range. We had one month's experience during a heavy run of *Anabaena* with a raw water pH ranging from 8.0 to 9.0. Results were very poor. It was necessary to feed lime with the ferric sulfate, but it was impossible to keep the pH at a consistent level through the plant. Even though the pH after introduction of the iron coagulant was about 8.5, it would drop to 7.5 on the filters and under 7.0 in the filtered water. The turbidity in the effluent averaged 1 to 2 ppm. with a color of 20 and an iron content of .5 ppm to as high as 1.0 ppm. obtained at times. Prechlorination of 1.0 to 2.0 ppm. did not help the situation. A return to a high alum dosage immediately cleared things up.

Continuous copper sulfate application fed into the plant influent looked promising due to the quick reaction in floc formation always experienced within an hour or two of treatment of the main reservoir, but has failed of fulfillment. Dosages as high as 2.0 ppm. of copper sulfate had no effect. It is felt that the copper sulfate should be introduced at a point considerably in advance of the alum so that the killing effect of the copper sulfate will be well underway before floc formation is begun. Our next attempt in this line will be at the intake where we will have the benefit of a contact period in about a quarter of a mile of 30 inch pipe.

Superchlorination of the raw water was attempted two years ago. We had a strong growth of *Coelesphaerium* to work on at a pH of about 8.0 and had no difficulty in effectively killing the organism and changing the green color of the raw water to a drab grey with a dosage of about 3.0 ppm., giving about .5 ppm. residual of free chlorine after contact in the settling basin. There was some improvement in floc formation and better quality of applied and filtered water, but it was felt that a longer contact time with chlorine before alum application would be helpful here, too. Also, our filters were not in the best of condition at that time as it was the end of a summer with our usual ineffective filter back wash conditions, and the principle effect of the chlorine was to unload the filters, giving bad tastes and odors.

Surface Wash and Anthrafilt for Filters

Since then, in anticipation of further experiments and to remove a dangerous situation, we have installed surface wash equipment on all filters. We now have really clean filter sand at all times, no mud banks or signs of mud balls. Operation in the late summer and early fall was not safe with back wash equipment that gave 30 per cent expansion and a four-minute wash to a filter. An accumulated load of alum sludge and mud remained on the filter sand at all times. It increased during the summer and fall and was never entirely removed during the better back wash conditions existing in the winter. Part of our program of algae control was providing equipment to maintain our filters at maximum efficiency at all times, to safeguard the quality of the water so that unexpected troubles would not find us with our equipment only partly effective.

Another part of our algae control program involved increasing the filters' efficiency by capping them with anthrafilt, a coarse filter medium that permits deep floc penetration of the filter instead of surface matting. So far, an experimental installation indicates about double the amount of water may be filtered per foot of head loss over the other sand filters. This applies to both summer and winter conditions. We are only awaiting the end of our year's trial to see how the anthrafilt layer has stood up before capping all filters.

Other Considerations

Algae control at the Margerie Plant is not a factor of winter and spring operation. The summer months of July, August, and September, and also of October pose the main algae problems. Not yet have we had to treat for algae in the spring. Our only fall problem is insuring good winter conditions, and it is possible from a study of the algae counts during November to predict good winter conditions and not to have to resort to a last copper sulfate treatment.

Any discussion of algae control always brings up the question of algae acquiring resistance to copper sulfate treatment. The fact that we are today getting as good results with smaller dosages than used previously would seem to answer that in the negative. We are of the opinion that algae treatment of any kind, resulting in artificial conditions due to killing off growths of algae, will upset natural biological equilibrium and will make subsequent treatments necessary. This is only true for deep reservoirs and where there is no seeding. Our East Lake Reservoir is a good example of natural equilibrium. Untreated and unseeded it seldom contains more than a few diatoms.

Following most treatments we run laboratory determinations on the amount of copper in the water. Traces will remain in the raw water for about five days. About one half this amount reaches the filters. We have never yet discovered a trace of copper in the filter effluent. We have found that such information is valuable in contacts with industries, the medical profession, and occasionally the public.

WEST LAKE SYSTEM

The West Lake System is made up of the main West Lake Reservoir which has no swampy tributaries and few shallow areas, and into which the Boggs Pond Reservoir flows by gravity. Boggs Pond is also fairly deep and is located in a heavily wooded area. As it is on the West Lake watershed it is normally kept full and permitted to overflow. The two Kohanzie Reservoirs are shallow and must be pumped to the West Lake Reservoir. They tend to seed West Lake with algae, so they must either be used before a copper sulfate treatment is necessary, or be treated before use. The total storage of this system is the same as the Margerie System, about 1500 million gallons.

The water is soft, of low mineralization, color, and turbidity, and was used for years without any treatment other than chlorination. It was always famous, however, for its bad tastes and odors. Since the watershed is not heavily inhabited and all private sewerage systems are inspected annually and are under the control of the State Board of Health and the local Water Department, there are no dangerous health hazards. The main problems are taste and odor control, corrosion control, and maintaining economical filter runs.

Filtration Plant

The West Lake Filtration Plant consists of two aero-mix units, giving some taste and odor, and carbon dioxide removal following alum coagulation, twin settling basins with 4.5 hours minimum detention time, six filter units operating at 2.0 gal. per sq. ft. per min., prechlorination and post chlorination, with Calgon used for corrosion control at a delivered water pH of about 6.0. The prechlorination plant, which safeguards about thirty families still using raw water direct, can only be visited once a day and so makes taste and odor control difficult as the safe chlorine dosage

for maximum flows gives superchlorination dosages on the night flows tending to unload the filter sand. So far it has not been advisable to practice superchlorination and dechlorination on a city wide scale continuously, although considerable experimentation has been done. Other plant facilities not at present in use are lime and activated carbon feed, and ammoniation.

Taste and Odor Troubles

From the time the ice goes off in March a careful watch is necessary at West Lake to keep ahead of taste troubles. With the first increase in water temperature we are apt to find *Dinobryon* present. *Tabellaria, Asterionella,* and *Synedra* we carry through the winter without much change, assuming treatment was properly handled in the late fall. Usually one of the above will begin a slow increase while the other growths remain static. The above diatoms will cause no taste trouble below 500 organisms per ml. and no filter trouble below 1000. If they are in the ascendancy we usually find treatment necessary along in May with an appreciable increase in temperature. *Dinobryon* causes taste troubles at levels above 300 organisms per ml., and will require treatment sometimes as early as the first week of April.

By using activated carbon we can delay reservoir treatment for several weeks, but if carbon is applied at its most effective point, directly on the filters, filter runs decrease by one half within a week. Carbon applied at the midpoint of the settling basins is not as effective and plugs the filters almost as quickly, while even very large dosages in the raw water are ineffective. Principally due to prechlorination, taste removal in the plant has not been successful.

Summer-Fall Treatment

During our summer period of July, August, and September we experience growths of *Protozoa, Cyanophyceae,* and *Chlorophyceae,* but the previously mentioned four organisms continue as our problem. Fortunately they do not increase rapidly and a maximum of two treatments during these months has kept conditions good. Our interest during this period is solely for taste control. Since the temperature of the water is at a maximum and our chlorine dosages are also at a maximum this is our most difficult time to deliver a palatable water. It is mandatory that we now observe our maximum limits of algae concentrations for treatment.

The fall period of October to freeze-up in December usually gives us our most active growths, but taste is not pronounced and so we treat only to give efficient filter runs. In late November and early December our major effort is to prepare for winter operation, so that we won't be caught by algae growing under the ice, a condition that will shorten filter runs and give tastes. If our so-called final treatment of about 2.5 lb. per mil. gal. is applied early in November we are almost certain to have an upsurge of another algae growth before freeze-up. By holding off until late November before treatment there will usually be no more growths although we watch carefully until ice forms for such an increase in another type. In the past eight years this has happened twice. Once, following *Asterionella* treatment we neglected a new growth of *Tabellaria* as insignificant, and suffered from a fifty per cent decrease in filter runs the whole winter season. On the other occasion we killed off a similarly increasing *Tabellaria* growth and had practically sterile conditions, insofar as algae were concerned, the entire winter.

The Portland Situation

by
F. W. MOHLMAN
Chicago

In my review "Sewage and Industrial Wastes in 1948," published in *Water & Sewage Works* for February, 1949, I stated,

"One new proposal in 1948 was made by Rawn; that sludge from the Portland plant be discharged back into the Columbia River, inasmuch as it would add very little to the oxygen-demand of the effluent and would save money. However, oxygen-demand is not the important factor in this problem, which is not a question of oxygen balance (in the river) at all, but rather the desire to get the sewage out of the Willamette River and to avoid too much bacterial pollution of the Columbia."

Mr. John W. Cunningham, consulting engineer of Portland, and vice-pres. of the A.S.C.E., feels that this does not state the conditions clearly, and that the engineers took into consideration the bacterial conditions as well as the oxygen balance.

I pointed out to Mr. Cunningham that the bacterial standards are about five hundred times more rigorous than oxygen balance (see Phelps, "Stream Sanitation," page 200), and that only bacterial conditions (coliform index) need be considered. The flow of sewage is an average of 60 mgd. and low flow of the Columbia is 75,000 cfs., giving a dilution of one to eight hundred. Few cities enjoy this great dilution.

For the initial operation I believe Mr. Rawn made a clever decision, to forego sludge dewatering and to discharge the digested sludge into the Columbia along with the effluent from primary treatment. A set of five determinations, made on Los Angeles sludge, indicates that the coliform index of the sludge will be reduced by digestion even more than will the B.O.D., thus giving reassurance that the bacteria will be satisfactorily reduced by digestion. However, as long as the Columbia water is used for water supply below Portland, the coliform index will be the major criterion of the success of the scheme. The B.O.D. increase will, in all probability, be unmeasurable.

For these reasons, I felt more attention should be paid to bacterial standards than to oxygen depletion. Both Mr. Cunningham and A. M. Rawn, consultant on the treatment plant and sludge disposal, feel that adequate attention has been paid to this factor. If so, discharge of digested sludge (unchlorinated) may be maintained. Furthermore, it is reported that the one community which utilizes the Columbia River below Portland as source of water supply will soon abandon the river.

*Director of Labs., The Sanitary District of Chicago.

N. I. H. Sanitation Study Section To Meet in Washington, D. C.

Symposium on Water, Sewage and Ind. Wastes on June 23-24.

A symposium on recent research in water, sewage, and industrial wastes is being sponsored by the Sanitation Study Section of the Division of Research and Fellowships of the National Institute of Health. The meeting will be held in Washington, D.C., on June 23-24 in the auditorium of the Department of Commerce at 14th and Constitution Avenue. Papers on important topics will be presented by a number of outstanding research men in this field.

Further information on this meeting may be obtained by writing to Henry L. Roahrig, Exec. Secy., Sanitation Study Section, Division of Research Grants and Fellowships, National Institute of Health, Bethesda 14, Md.

POROUS PLATE FILTER UNDERDRAINS

A Report *

by

FRANK C. ROE
Development Engineer
THE CARBORUNDUM COMPANY
PERTH AMBOY, N. J.

MORE than four years have passed since the last published report on this successful development. "A lot of water has trickled through porous plate filter bottoms" since then and some 200 installations have now been made. The oldest ones have been in service 13 years. This considerable experience has clearly proved existence of the benefits of eliminating all graded gravel which has had such a wide appeal to engineers ever since the idea was conceived.

The purpose of this report is, therefore, to provide technicians in the entire water works field with an up-to-date outline of experiences. Elements of the subject to be described are: scope of application, design, development and details, limitations, cost of installation, and noteworthy installations.

The early history and development of the porous plate under-drain idea will not be repeated. Neither will this report include a detailed outline of the advantages and resultant savings. The reader is referred to the April, 1945, issue of *Water Works & Sewerage* (now *Water & Sewage Works*) for such a background.

*Prepared at the request of the editors of *Water & Sewage Works.*

SCOPE OF APPLICATION

It is apparent when analyzing the many installations of "Aloxite" (aluminum oxide) underdrain plates that they have now been applied to nearly every possible filter design and type of water treatment. Some applications were bound to be better than others, but all have provided the basic benefit of eliminating the operating troubles and expense inherent with most designs that employ graded gravel filter media support.

A brief classification and statement of special features of each general use follows:

1. **Gravity filters—new construction.** This use permits greatest first cost advantages in that vertical dimensions of structure, piping, etc., are minimized and lowest cost plate installation is possible. (See Fig. 1.)

2. **Gravity filters — old construction.** All early designs permit reconstruction with porous plates but the cost varies somewhat. Some old filters are shallow and do not permit adequate rate of backwash, but rehabilitation with "Aloxite" plates generally permits lowering of media enough to allow full rate backwash. (See Fig. 2.)

3. **Pressure filters — horizontal.** "Aloxite" plates are easily adapted to both new and old construction through simple welded structural support beams (angles or channels) in transverse direction only. Operators like the simplicity and safety of porous underdrains for pressure filters where filter media cannot be seen and backwash adjusted if necessary to suit conditions. (See Fig. 3.)

4. **Pressure Filters—vertical.** Large sizes of both new and old units utilize "Aloxite" plates readily with welded support beams at proper elevation running in one direction only. (See Fig. 4.) Small sizes are built with a single porous disc supported on a flange at the bottom. (See Fig. 5.) It is apparent that a substantial saving in overall height of unit is possible because of gravel elimination.

Fig. 1.—Installation At Austin, Tex.

Preparation of Pier Supports
(Note forms in foreground with hold-down bolts in position.)

Completed Filter Bottom
(Note hold-down angles along walls. Later construction uses keyway and grout.)

5. **Gravity softeners—lime process.** This application offers the same potential benefits as normal gravity filters. It is necessary to exercise good control over treatment as will be described hereinafter under "limitations." Several installations have provided variable results but there is ample evidence of complete success.

6. **Gravity softeners—Zeolite.** The usual benefits obtained through the same designs employed for other gravity type units apply here. In addition, there is the important advantage of positive protection of the relatively valuable softening media.

7. **Pressure Zeolite Softeners—Down flow.** The same designs used for pressure filters apply to this application. The possible saving in steel shell cost due to gravel elimination may be utilized for more Zeolite and thus provide the additional advantage of greater softening capacity. Protection against loss of Zeolite through underdrain system is again an important advantage.

8. **Pressure Zeolite Softeners—Up flow.** "Aloxite" underdrain plates are not particularly adapted to this design or principle of operation. It is true that they will still eliminate the necessity of graded gravel support but unless water being delivered to such softeners is free from turbidity, clogging of porous plates may develop and may not be eliminated by backwash.

9. **Brine tanks.** An incidental but very practical application for porous plate underdrains is in brine tank bottoms. A thin layer of sand is used on the plates to support the salt and protect plates from any foreign solids.

10. **Iron Removal Filters.** Both gravity and pressure units are in successful operation for iron and manganese removal. The important prerequisite for this application is that an adequate settling period must follow aeration. Without this, filter media may not have ability to completely remove the iron or manganese hydroxide floc.

11. **Ion-exchange units.** It is apparent that the advantage of using porous underdrains in Zeolite softeners make them equally adapted to cation exchange units where an even more valuable media is protected against loss. Porous plates are not recommended for anion exchange units because the constant use of caustic for regeneration will ultimately attack the ceramic bond of plates and weaken the structure.

The wide range of applications of the porous underdrain system as outlined has found an equally wide field of utilization. In approximate order of importance this is as follows:

1. Municipal water supplies
2. Industrial water supplies
3. Swimming pool filters
4. Camp water supplies
5. Domestic or small industry supplies
6. Industrial waste filtration.

DESIGN DEVELOPMENT

The Carborundum Co. introduced and promoted the porous plate underdrain principle for rapid filters as an outlet for materials which it produces. It was impractical to extend engineering activity and service to the usual level of equipment manufacturing since the company is not organized to develop specific designs involving other materials or to make installations. As a result of this circumstance, a great many ingenious adaptations of porous plate underdrains have been created by regular equipment manufacturers and inter-

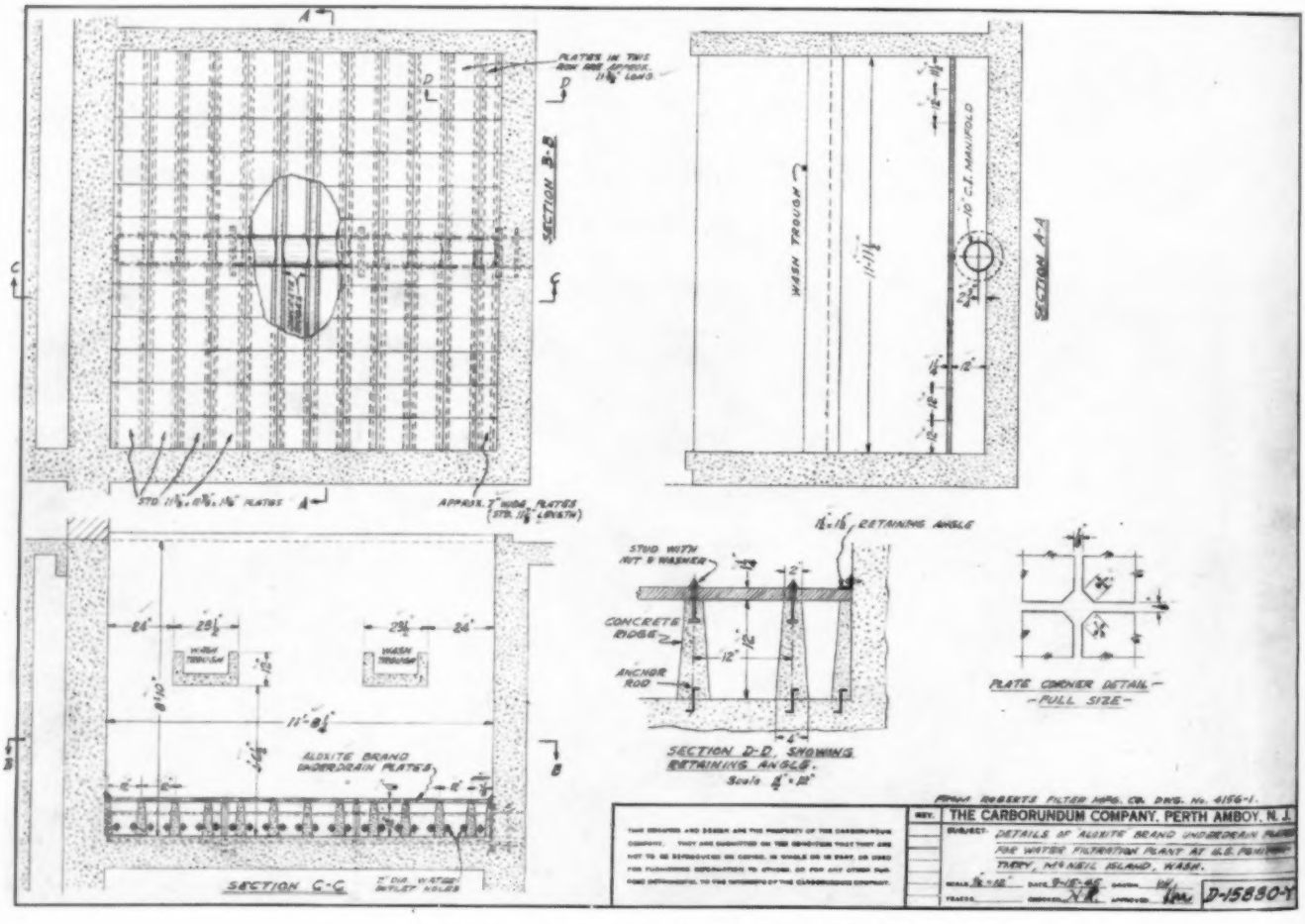

PLATES IN THIS ROW ARE OFFSET 11½" LONG
SECTION B-B
WASH TROUGH
10" C.I. MANIFOLD
SECTION A-A
STD. 11½" x 6½" x 1½" PLATES
APPROX. 7" HIGH PLATES (STD. 11½" LENGTH)
4" x 1½" RETAINING ANGLE
STUD WITH NUT & WASHER
CONCRETE RIDGE
ANCHOR ROD
SECTION D-D SHOWING RETAINING ANGLES
Scale 4" = 1'-0"
PLATE CORNER DETAIL
-FULL SIZE-
ALOXITE BRAND UNDERDRAIN PLATES
SECTION C-C
THE CARBORUNDUM COMPANY, PERTH AMBOY, N. J.
DETAILS OF ALOXITE BRAND UNDERDRAIN PLATES FOR WATER FILTRATION PLANT AT U.S. PENITENTIARY, McNEIL ISLAND, WASH.
D-15890-Y

Fig. 2.—Reconstruction with Porous Underdrain Plates
(Piers formed over old manifold. Pipe laterals removed.)

ested individuals. It is believed that such broad activity has contributed considerably to the widespread successful applications listed above.

Among the designs which have been or are being developed by equipment manufacturers, those described in the following paragraphs are of particular interest:

ABW (Automatic Back Wash) Filter—Hardinge Co. The design illustrated by Fig. 6 has the distinct feature of a unit that remains in continuous operation at a uniform rate of filtration. Small sections of the filter are likewise backwashed continuously on a progressive cycle with water pumped from the filtered supply.

An additional feature of this design is that a filter media depth of only 12 in. has been employed in installations to date. The oldest installation at Newton Falls, N.Y., has been in continuous service for about four years and has been eminently satisfactory.

Camp (3 Point Support) Design—Walker Process Equipment, Inc. Fig. 7 illustrates the principle of this method of supporting and holding down underdrain plates which has now been used successfully in several installations. The particular feature of this design is that a uniform stress on the porous plate material at the points of support is inherent during installation and operation.

Added features of this design are: (1) simplicity and potentially low cost installation; (2) uniform backwash pressure throughout area under plates (assuming velocity heads are dissipated).

Pressure Filters and Zeolite Softeners. A number of manufacturers have made complete units incorporating "Aloxite" underdrain plates or discs with designs similar in principle to Figs. 4 and 5. One of the most progressive is National Tank Company of Tulsa, Oklahoma.

It is believed that this activity would be more extensive were it not for the fact that many established filter manufacturers already have their own special or patented designs. They are naturally reluctant to drop such designs and production facilities in favor of a radically different principle. But since the basic advantages of the porous plate underdrain system are particularly applicable to this type of equipment, it is likely that new designs will be offered from year to year.

Special Designs. It is apparent from the illustration of a vertical circular pressure filter that special underdrain plates are made to fit the periphery. This involves a small increase in cost on a unit area basis but indicates that unique or special designs are possible where required.

Among the most interesting special designs submitted since the last published report are those involving annular shaped filters. These may vary from small diameter to large diameter units where the inner area forms the sedimentation tank. Trapezoidal shaped underdrain plates are best adapted to such designs. They are normally bolted to radial piers or beams but may be supported on long bolts or columns at joint intersections.

DESIGN DETAILS

The importance of perfection in such details as holding down bolts and joint sealing in the design of a porous underdrain system is obvious. There can be no "weak links" or all the inherent benefits of eliminating gravel are voided. Practical installation and operation experience has proved invaluable in developing good design details and in discarding poor details. Some of the more important features follow:

Plate Support. Most gravity filter designs to date have utilized parallel concrete piers as a means of plate support as illustrated by Fig. 1. When properly anchored to the filter

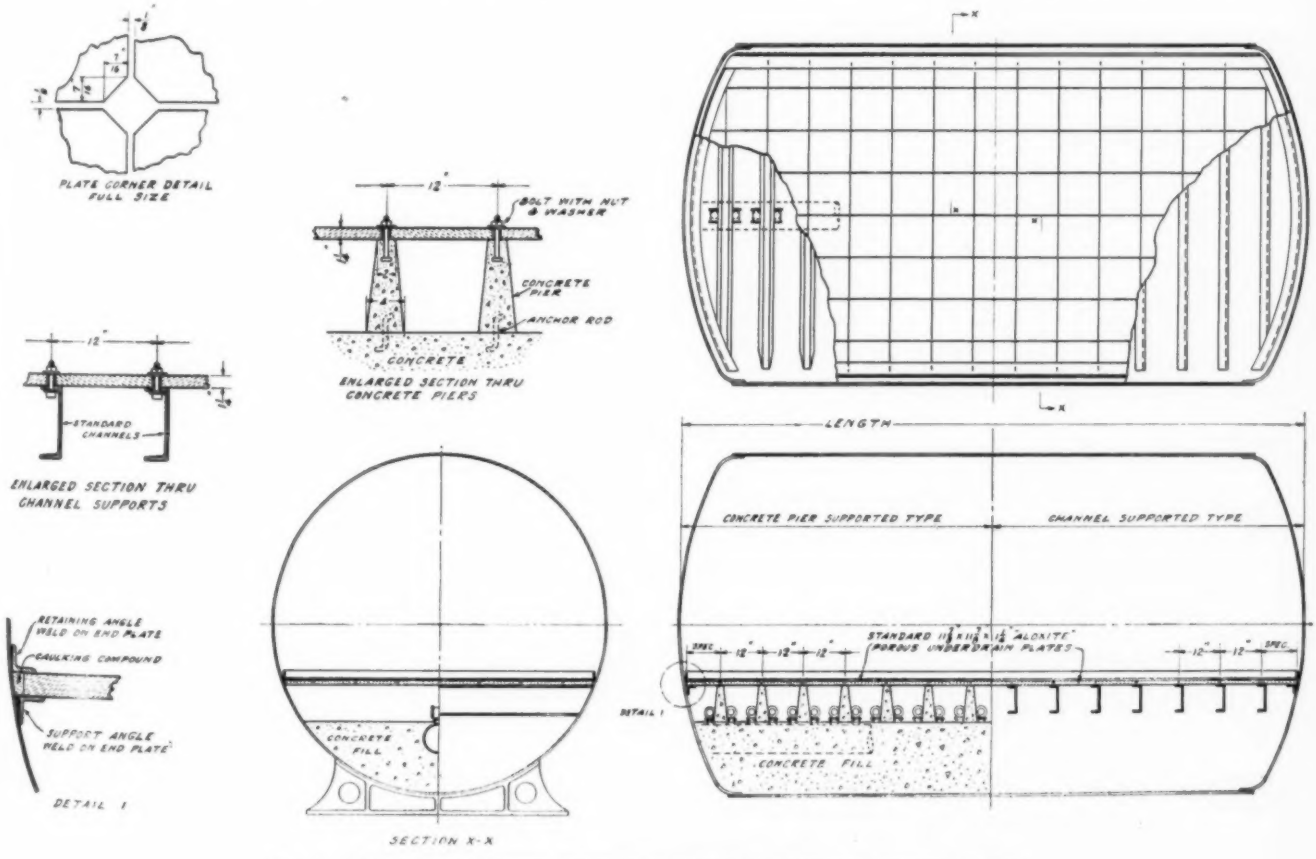


Fig. 3—Adaptation of Porous Underdrain Plates To Horizontal Pressure Filters

(Right hand side shows usual steel support; left side shows use of concrete piers on old concrete fill.)

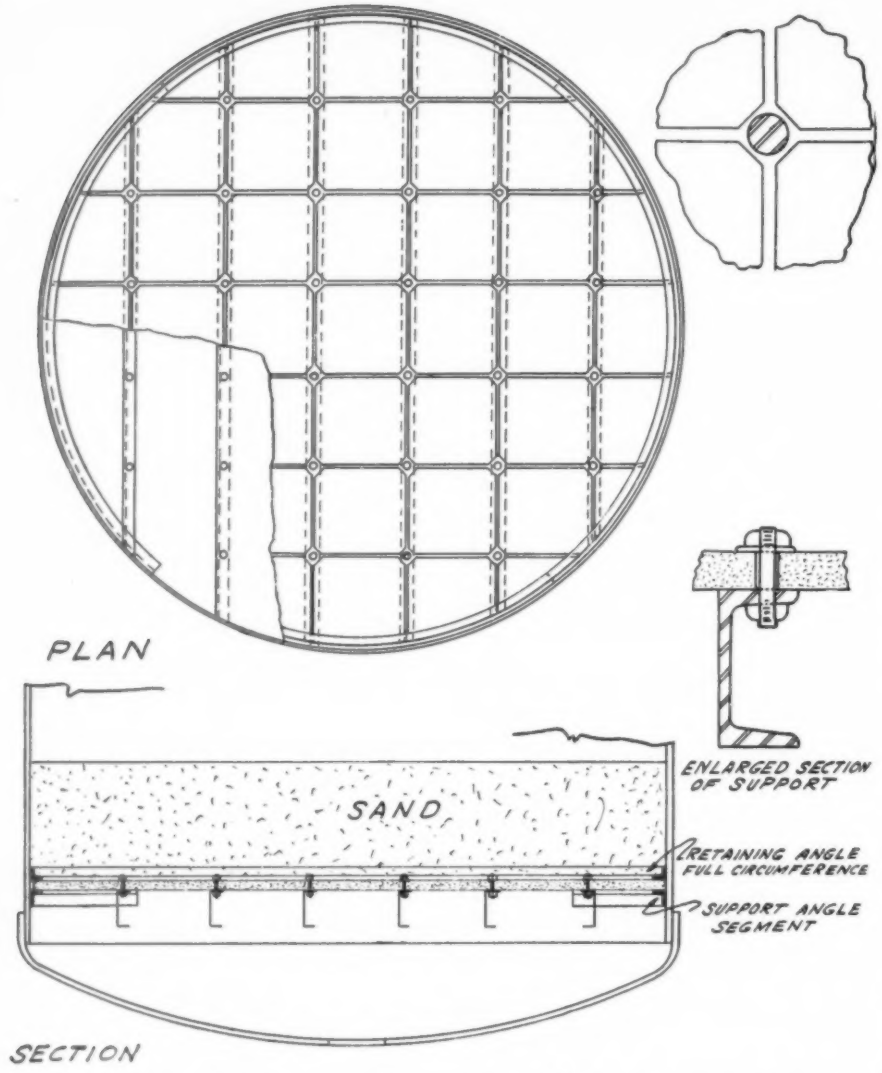


Fig. 4—Typical Vertical Pressure Filter Using Porous Underdrain Plates

floor and with hold-down bolts looped under a light reinforcing, they provide good rugged construction. They are usually 2 in. wide at the top and slope to 4-in. at the bottom with sufficient depth for good wash water distribution.

Structural steel channels, angles and tee bars have been used extensively; especially in pressure units. Unless a non-aggressive water is being filtered this construction must have a permanent protective coating. To avoid stress on porous plates, sections must be sufficiently heavy or spans so short that deflection is negligible.

Several installations have been made in Sweden using structural timber supports and with plates anchored thereto by lag screws. The kind of timber is unknown but it must obviously remain in good condition during continuous submersion in water, such as would probably be the case with cypress. These timbers are also anchored at intervals to the filter floor.

Long bolts are used as the only support in the Camp (3 point support) Design offered by Walker Process Equipment, Inc. They may also be used at plate corners exclusively as a 4 point support. In either design, a nut and large washer is used under the plates as well as on top.

A novel variation of the 4 point bolt support design was used recently at Barberton, Ohio, designed by E. D. Barstow, Akron. The bolts were surrounded by concrete encased in 4-in. vitrified tile pipe, thus forming a rugged and corrosion resistant column support.

To avoid undue stress on the structure of porous plates it is important that they have a uniform bearing regardless of type of plate support. This is easily and normally accomplished by setting plates before the bedding course of joint sealing material has hardened.

Bolts. Permanent retention of strength through resistance to corrosion is the important pre-requisite of hold-down bolts. Stainless steel or "Everdur" are generally recommended. Ordinary galvanized steel bolts can be used where the water is not aggressive.

Whether long bolts are used as the only support or short bolts with pier support, they must be thoroughly anchored. A hook or ell is recommended for anchorage at a minimum depth of 3 in.

Short anchored bolts, bolts for structural support and lag screws for timber, need only be ⅜ in. diameter stock although ½ in. has been used frequently for added safety factor. Where they provide the only support, at least ½ in. diameter bolts are recommended.

Washers. While this would seem to be an unimportant detail, it cannot be neglected. Heavy round or square washers at least 1½ in. across must be used. They should be of the same metal used for the bolts.

Joint Sealing—Method and Materials. This step in design has probably received more attention than any other detail. It is apparent that poor workmanship or unsuitable material could result in minor "leaks" in a filter bottom through which the media could be lost.

"Aloxite" porous underdrain plates are intentionally manufactured ⅛ in. short of standard 12 in. x 12 in. laying dimensions (or other required special dimensions), as an allowance for joint sealing material. The standard tolerance on plate surface dimensions is ±⅛ in., as required for such a kiln-burned product, but any run of plates will average close to the nominal 11⅞ in. standard dimension. The ⅛ in. joint allowance is therefore assured within reasonable practical limits.

A great many installations have been made with phenol free asphalt joints such as the G-K compound made by Atlas Mineral Products Co.

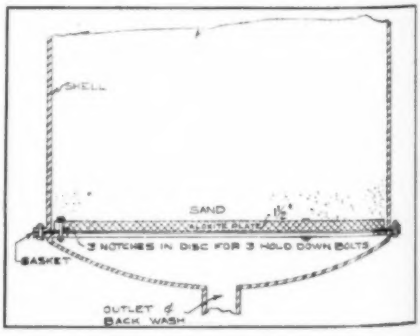


Fig. 5—Method of Installing Plates in Pressure Filters, Softeners or Ion-Exchange Units *(Devised by Wilson Engr. Co., Little Rock, Ark.)*

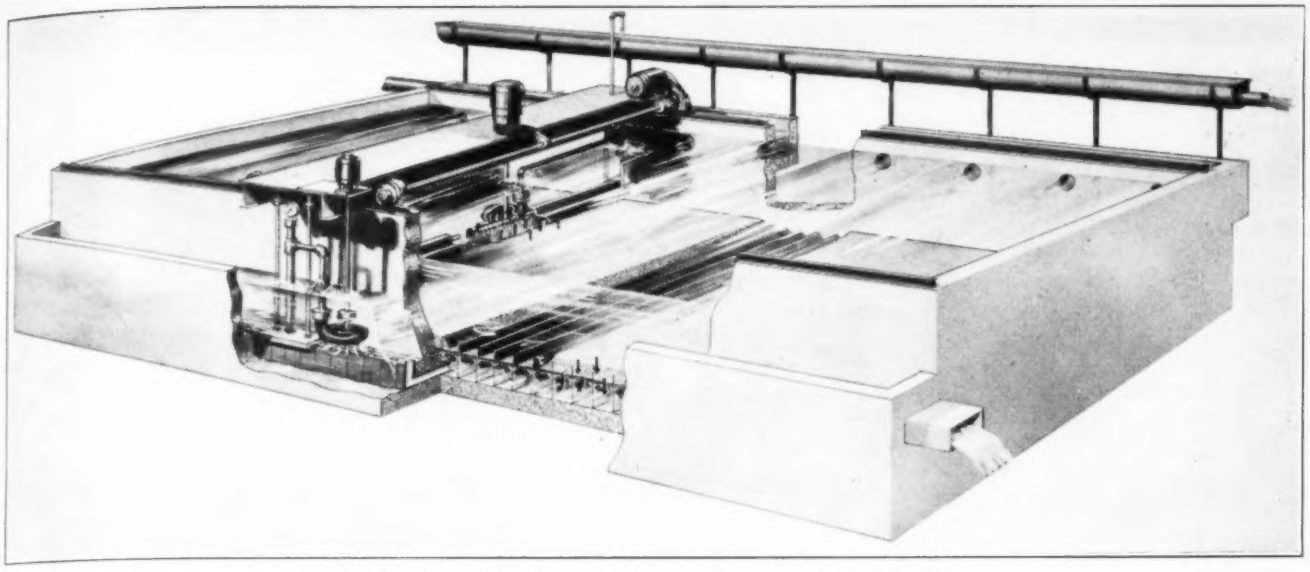


Fig. 6—Hardinge ABW Filter Equipped with Porous Underdrain Plates

of Mertztown, Pa. Many installations have also been made with "Lumnite" cement and even with Portland cement but these alone do not provide the resiliency which is recommended for possible slight expansion.

More recently Walker Process Equipment, Inc., has used a Latex base cement with bentonite filler which appears to be quite satisfactory. Normally, there is no problem of bonding joint sealing material to underdrain plates because of their very coarse porous structure. But the material must be of a proper consistency for thorough jointing without running out and *workmanship must be of high quality.*

Joint sealing is simple where the joints are supported. The unsupported butt joints between piers and all joints where bolts are used alone, must be thoroughly and carefully "buttered" when plates are set.

Wall Joints. Several designs have been used satisfactorily as illustrated by Fig. 8. On new construction, the two methods employing keyways are very economical. For old construction, the method using special plates notched for hold-down bolts 2 in. back from the wall, is most economical. It is also favored where there is objection to use of metal support and hold-down angles. Joint sealing is more simple and positive, however, where the angles are used.

CLOGGING POSSIBILITIES

In the last (1945) report referred to, the statement was made that porous underdrain plates will not clog if normal and reasonable operating practice is followed. Added experience only confirms the accuracy of this statement. The explanation was, and is, simply, that if a properly treated and filtered water passes through underdrain plates to the clear well (or distribution system) and if only such water is used for backwashing, there is nothing to cause clogging.

It is possible that certain practices of subnormal operation or unusual circumstances will develop which can cause clogging. These unexpected and undesirable conditions were discussed in a recent publicized "Bulletin on Porous Media by Carborundum," as follows:

1. Use of raw water (containing suspended solids) for backwashing! This could ultimately clog plates seriously from the underside.
2. Inadequate coagulation and settling or exceptionally high rates of filtration with coarse filter media! This may force solids or fine floc through to porous plate underdrains. Most of it would pass through plates, but some could accumulate in the pores over a long period.
3. Little or no sedimentation following aeration of water containing iron and manganese! Filter media is unable to remove all hydroxides that are formed and some of these solids will accumulate within porous plate underdrains.
4. Application of highly unstable water to filters in lime softening plants where carbonate incrustation may extend beyond the bottom of the filter media! It is possible that pores of plates will become coated and ultimately plugged, although control of this condition is practical and economical.

It can be reported that "Aloxite" plates have not clogged seriously under many conditions bordering on abuse. In a very few cases of subnormal use as outlined above, the corresponding recommended remedies are as follows:

1a. The only positive remedy for plates seriously clogged by inorganic suspended solids in raw water used for backwash is removal, replacement and subsequent use of filtered water supply. It is possible to restore considerable permeability by reburning plates at the original firing temperature of approximately 1350°C., but this is expensive and somewhat uncertain.

2a. In two or three cases where alum floc had penetrated filter media and pressure loss increase through underdrain plates indicated partial clogging, the application of sodium hydroxide was most effective. It was applied directly to the filter, without removing media, in a 2 per cent solution and allowed to saturate the plates from 8 to 16 hours (overnight). A thorough backwash followed and normal pressure loss through plates was noted thereafter. Incidentally, this is known to be an excellent method of cleaning the filter media simultaneously.

3a. The removal of iron and manganese hydroxide from underdrain plates so clogged is slightly more expensive, and more care is essential in handling the solvent. The application of 2

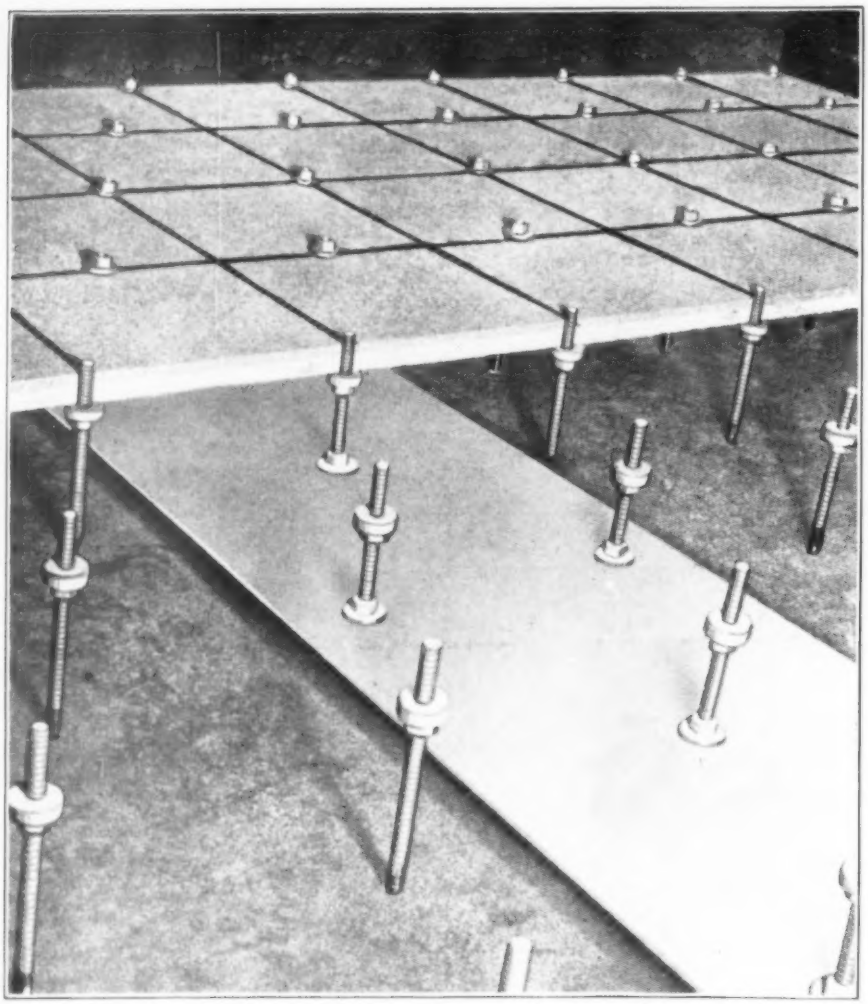


Fig. 7—Camp (3 Point) Support Design

to 5 per cent inhibited hydrochloric acid is recommended for iron clogging alone with a small addition of anhydrous bisulfate of soda when manganese is present. This also accomplishes an excellent cleaning of the filter media.

4a. Carbonate incrustation resulting from unstabilized lime softened water can also be dissolved with inhibited hydrochloric acid. It can be used sparingly, i.e., without any excess so that there is no attack on concrete which would have the same (or greater) thickness of carbonate coating as plates and filter media.

COSTS

It is apparent when considering the many different designs involving porous underdrain systems that the cost of installation will vary considerably. Utilization of porous plates on new construction, for example, is quite low in cost as compared with the total cost of reconstructing some old filters.

Standard "Aloxite" underdrain plates, 11⅞ in. x 11⅞ in. x 1¼ in. to serve one foot square, are now $2.80 each in quantities, with freight allowed to the job. The cost of all other materials on a new economically designed job, including support structure and all labor of installation, will normally not exceed $2.00 per square foot.

It is estimated from the above that new jobs should cost about $4.50 to $5.00 per sq. ft. depending on size and location. Reconstruction of old filters will obviously vary a great deal more; probably from $5.00 to $7.00 per sq. ft.

In comparing first cost of a porous plate underdrain system with any other filter bottom design, it is necessary to *include the cost of graded support gravel in place with the latter.* The cost of extra filter depth to accommodate such gravel should also be added, although it is rarely done in making comparisons.

During the summer of 1948 actual proposals were received at Austin, Texas, on five (5) different present-day established filter bottom designs. The design utilizing "Aloxite" plates was low by an appreciable margin and construction proceeded therewith.

While the foregoing discussion refers only to original installation cost and is generally favorable so far as porous plate underdrains are concerned, the final basis of any comparison should be on total annual cost. Savings in cost of operation with porous plate underdrains are intangible and variable. Plant superintendents and operators can provide the best estimates to use because they alone know comparative advantages.

There are instances where porous plates have eliminated an annual filter rebuild with considerable additional saving of filter media. Many operators report that filters with porous plate bottoms wash in as little as 50 per cent of the time formerly required. Such savings can be definitely evaluated.

In summary, it can be reported with conviction that the annual cost of filters equipped with porous plate bottoms is low in comparison with other types or designs of filter bottoms. In no way does this evaluate other considerations of importance to plant superintendents such as added capacity, elimination of lost time for rebuilds, etc.

INTERESTING INSTALLATIONS

There is sufficient background material under this subject alone for a paper; in fact, the construction and operation of many single installations have already been the subject of published articles. It is therefore only possible to cover some of the high spots.

Perhaps the most notable fact about installations of "Aloxite" porous underdrain plates is that the first two and about 70 of the 200 odd jobs to date have been adaptations or reconstruction of unsatisfactory or inadequate old filters employing "upsettable" graded gravel. These are too numerous to list but it is most likely that at least one of every known type of rapid filter bottom built, up until perhaps 20 years ago, has been replaced with a porous plate bottom.

The first two installations referred to were at Denver, Colo., and Grand Rapids, Mich. They have been in service about 13 years, although a temporary shutdown at Denver last year gave proof that raw water must not be used for backwashing. This was done only in an emergency resulting from water shortage, and the operators expected the underside clogging of plates which occurred.

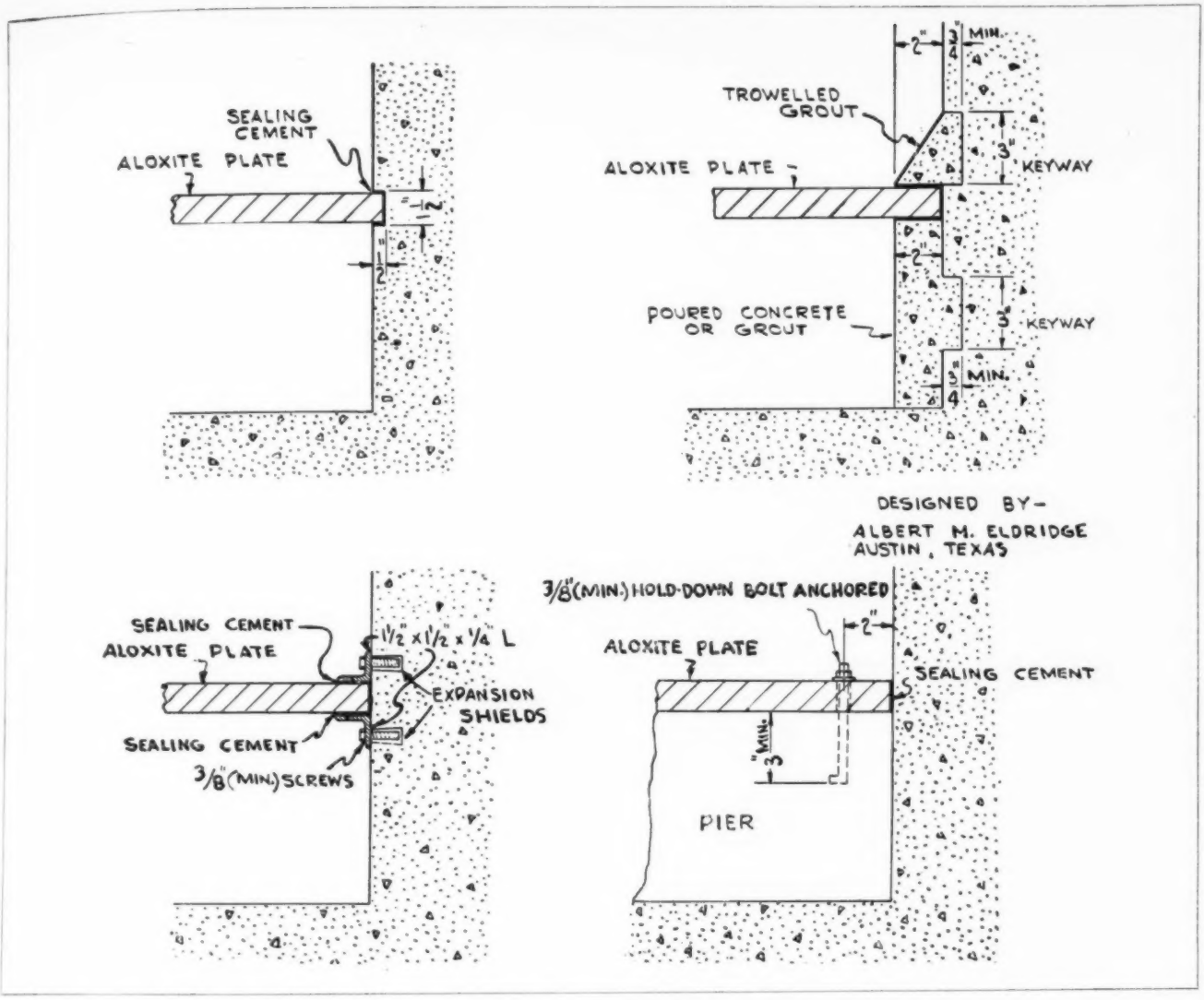


Fig. 8—Methods of Installing Porous Underdrain Plates Along Walls

The experience at New Brunswick, N. J., is one of the most interesting of the "rehabilitation" jobs. The first filter was rebuilt in 1942, and the program carried on continuously through 1947 when the last of 8 gravity filters was completed. It is obvious that the advantages of the porous plate bottom were appreciated and desired by the operating personnel or additional installations would not have been made.

An installation at Lyons, N.Y., involves a combination of relatively modern developments that has provided exceptionally good results. "Anthrafilt" was adopted as the filter media and "Aloxite" underdrain plates installed to eliminate gravel and provide additional necessary depth. Palmer surface wash equipment was also installed to supplement the low rate, but now uniform, backwash.

American Celanese Corporation near Cumberland, Md., experienced heavy losses of filter media and Zeolite from its filters and softeners until "Aloxite" plates were installed in existing horizontal pressure units. Of even greater economic importance, this reconstruction has permitted operation at much higher rates of filtering and softening.

There are numerous installations where operators report using less wash water than required by other filters in the same plant. Some of these are Mamaroneck, N. Y., Ft. Smith, Ark., DuQuoin, Ill, Fayetteville, Ark., Litchfield, Ill., and Austin, Texas.

The Austin, Texas, job (see Fig. 1) is of particular interest because it is lime softening (slightly unstabilized) and is consequently the most difficult condition to meet. Two filters have been in service continuously for two years with no increase whatever in head loss through underdrain plates. During periods of critical demand for water they were operated at rates approaching 4 gal. per sq. ft. per min. Two additional filters equipped with "Aloxite" plates will be put in service this year. Of incidental interest at Austin is that branch wash water gutters are eliminated and filter height reduced to take advantage of gravel elimination.

The Ford Motor Co. plant at Flat Rock, Mich., is another interesting lime softening plant. When porous plates were originally adopted for a "rebuild", a low-priced but improper grade plate was purchased. These clogged in time and have been replaced with "Aloxite" plates which have given subsequent satisfactory service.

Construction of new filters or rebuilding of old filters equipped with porous plate underdrains has increased steadily and is now at its highest level, with at least 12 plants under way. Among the largest and most interesting is a 10 mgd. reconstruction job at Rock Island, Ill., designed by Greeley & Hansen, Chicago.

OPERATION OF SMALL WATER PLANTS

Office Personnel and Procedures

by

A. E. CLARK,
General Manager,
NASHVILLE SUBURBAN UTILITY DISTRICT
NASHVILLE, TENN.

THE office of a public utility should reflect the general overall efficiency and workmanship of the utility regardless of the type.

The consumers usually judge the services rendered by a water department by the quality of water and the abundance of flow from the tap, but good workmanship, appearances and efficiency also have a distinct psychological effect on the consumer. The office should be pleasant, well arranged and well lighted, with sufficient space to carry out the office procedures without confusion. Files and other materials which are necessary to consult for a consumer's record should be so arranged that a minimum of time is required to locate the record. The average consumer is usually patient, but he can be impressed if his wants are attended to with little delay. The consumer's judgment of the department is swayed to a considerable extent by the personnel with whom he comes in contact.

The personnel in the office should be selected with care, particularly those who will meet and deal with the public. All should have a pleasing personality and be able to discuss a consumer's problem intelligently and patiently without becoming irritated. This does not mean that the employee must take abuse from anyone. If there is abuse, rather than display temper the consumer should be referred to someone higher up. In order to discuss the various complaints the employee must be familiar with the

The Author

general procedures and practices of the water department and must also be familiar with the established policies. The employees should be instructed to satisfy the consumer if possible and many times this is done by the pleasant manner in which the consumer is treated. This applies not only to personal contacts but also to telephone conversations. Many people do not understand how to use the telephone properly. If there is any question in regard to the proper use of the telephone this problem should be referred to the local office of the telephone company, which many times is in a position to render valuable assistance in training the personnel. A pleasant telephone voice and proper manner can work wonders. It should be impressed on the employees that it is much easier to make a remark over the telephone at which the consumer can take offense than when talking to him in person. Employees will talk amongst themselves and sometimes will unthinkingly make remarks not complimentary to a consumer. This practice should be discouraged even though the conversation has no bearing on the work. It not only slows down the work, but if work is in progress may be responsible for errors. The office employees should be thoroughly instructed in the established policies of the department, as well as general practices and procedures. As an example, if an employee is expected to discuss water bills or meter connections, then that employee should have some knowledge of a water meter and a meter connection. This information is best obtained by taking the employees to the meter shop and having the meter foreman explain the general principles of the operation of a meter as well as how it is read. They should also be taken to the field and shown the actual operation of making a meter connection, including tapping the main. This does not mean that the employees are to be so thoroughly instructed that they would be expected to make a meter connection, but the idea is to familiarize them with the procedures so that they can discuss them intelligently with the consumers.

Record Filing for Quick Reference

Office records and procedures should be set up to enable the employees to carry on their work efficiently and with the least amount of work consistent with the necessary

Meter Tag Number

Location

Set Date	Size-Make-Serial No.	Out Date	Set Date	Size-Make-Serial No.	Out Date

Fig. 1—Record Form on Meter Card Envelope

Meter Serial Number

Meter Make Size

Set Date	Location	Tag No.	Date	Set Date	Location	Tag No.	Date

Fig. 2—Record Form on Meter Card Proper

information desired. The filing of correspondence and records should be such that either can be found quickly and easily by anyone in the office. The index of consumers should be of a type which lends itself to rapid finding of a consumer's name, address, code number and meter book number. An index should also be made of all streets, showing the meter book in which each street is located. If this information is carried in the index for each consumer then little time is required to locate the ledger sheet showing his account, or if reference to the meter book is necessary that also will require a minimum of time. Similarly, the ledger sheet carries the meter book number at the top of the sheet so that if reference is to be made to the meter book from the ledger sheet, that information is readily available without having to refer to another file to locate the meter book number. The code or account number for each consumer can be shown in three places, 1) customers' index, 2) top of ledger sheet, 3) top of meter book sheet. This has its advantages in that whatever record of the consumer is being checked the other record can be quickly found without having reference to any other file. Ledger sheets should be kept in posting trays because of the ease of handling and transfer from one part of the office to another.

All permits issued should be numbered and can be either padded or in book form, having the original and duplicate in different colors. If padded forms are used the duplicate should be filed in accordance with the numbers in sequence; or, if the book forms are used then the numbers covered by the books should be put on the end and the books filed so that any permit previously issued can be readily found providing the number is known. A record on a mimeographed form can be kept of each permit issued showing the permit number, date issued, name, address, amount collected, etc. This helps considerably if inquiry is made regarding the issuance of a permit on a certain date or within a certain time. When a new consumer signs up for water, paying a meter deposit, the original copy of the deposit slip is given to the consumer and the duplicate is filed according to number. At the same time a record can be made in a ledger book giving the number of the permit, date, name, address and amount of deposit. As in the case of other permits issued, this provides a record of deposit slips issued and expedites checking for bookkeeping as well as readily finding information revealing when or if a certain deposit slip was issued.

FIELD ORDER **NASHVILLE SUBURBAN UTILITY DISTRICT**

Name_____ 19____

Address_____

Tag. No._____ Meter No._____ Acct. No._____

- ☐ Read Meter
- ☐ Test Meter
- ☐ Check Premises for Leaks
- ☐ Pressure and Flow Test at Meter and House
- ☐ Turbid Water—Blow Off
- ☐ Turn Water Off
- ☐ Re-read Meter
- ☐ Dead Meter (Change)
- ☐ Check Occupancy
- ☐ Leak Reported
- ☐ Renew Service
- ☐ Turn Water On

Remarks_____

Date Completed_____

Office Signature_____ Field Signature_____

Fig. 3—Field Order Slip 4 x 6 Inches

When a permit is issued for a new meter connection this means that an order must go to the field to do this work. A socalled tap-card can be used. All information is given on this card for the use of the field crew and it must be specific, such as permit number, name, street, lot number, size of main, size of tap and meter, location of the new connection between two streets, and side of street on which main is located. When this work is completed the card is returned to the office with additional information showing date job was done, tag number on meter, make and size of meter and serial number, along with a requisition showing the materials used. This gives the clerk and bookkeeper information for completing the office records such as meter sheet for future reading, ledger sheet for future billing, new plate to be made up for the addressing machine and charging the labor and materials out. Filing of tap-cards is usually done by streets; however, a cross index file can be used, filing by street and tag number. A meter card accompanies the tap-card. It shows all information regarding the meter set at this location and establishes a permanent record for this meter.

Meter Records

Meter records in the smaller water plant are usually kept in the office. It is very important that a record be kept on every meter regardless of whether it has been set or is in the shop for repairs. The following has been found satisfactory. The meter make, serial number, size and tag number is placed at the top of the meter reading sheet for that address. An envelope on which the information in Fig. 1 appears is used, along with the card which carries information shown in Fig. 2. After the information has been taken from the meter card and put on the envelope and file card, the meter card is placed in the envelope and filed in sequence according to *tag* number. The other card is filed under the make and size of meter according to *serial* number in sequence. When a meter is changed at any address the meter card in the envelope is removed and replaced with the new meter card. The old card is then filed in the shop card-file until this meter is repaired and placed in service again. Then a new card is sent in from the field and the shop card is removed from the file and destroyed. The above system gives a cross index on all meters, so that the record can be found if either the serial number or tag number is known.

When new meters are received a record is made of the serial numbers and as the meters are placed in service they are checked off the list and at the same time a permanent record is made in a ledger book of the original setting of the meter showing the tag number, address, make and size of meter and date set. This provides an easy method of keeping track of the number of meters in service.

Field orders are very helpful in keeping a record of routine meter readings, checks for leaks, etc. The type which has proven quite successful is shown in Fig. 3. It will be noted that it is only necessary to check the operation to be done in the field. These forms are padded with an original in white and duplicate in yellow. When the order is made out the original sheet is sent to the field and the duplicate is filed. When the original is returned from the field showing that the particular job is completed,

the duplicate is pulled and destroyed and proper action taken on the original which is then filed for future reference. It is surprising how frequently these order records are referred to.

Water used during construction, whether a residence or business, amounts to quite an item. Various methods have been used for charging for the water used. These include—(1) flat rate; (2) materials used (brick, concrete block, plaster, etc.); (3) metering. The writer believes that all water used during construction should be metered and the contractor charged the regular rate for water at the prevailing rate in the community. An easy way to set this up is to treat the contractor in the same manner as a regular customer—i.e., set the account up on the ledger sheet and bill him each month until advised that the job is completed. At such time the permanent owner or occupant will sign up for water service. If the residence or building is not to be occupied immediately the water is shut off at the curb stop until such time as an occupant signs for water service.

Purchase Orders

All purchases of materials and equipment, except small amounts paid from petty cash, should be made by means of purchase orders and usually based on a requisition from the field. A method which has been found satisfactory is to have the purchase orders in triplicate, each a different color. The original is sent to the vendor, the second copy is given to the bookkeeper and the third is filed in a folder by number in sequence. When the invoice covering the purchase is received from the vendor the requisition and purchase order are attached completing a record of the purchase.

Petty cash is sometimes a cause of trouble, depending on the method of handling. If not handled properly this can be the means of considerable loss over a period of time. The writer has found the use of petty cash slips very satisfactory. When any money is paid out of the cash drawer a petty cash slip showing to whom paid, amount, purpose, date and account to be charged. Any receipt received from a small purchase is attached to the petty cash slip. Petty cash slips can be signed by only one responsible person in the office.

Bookkeeping procedures are usually set up more or less along standard lines. There may be items in one water works which differ from those in another, but whatever setup is used, it should provide all necessary information for the proper operation of the financial end of the department.

The above is presented to cover the general office setup for the small water works and does not attempt to include the many details which are peculiar to each office, nor to enumerate other forms or procedures which might apply to each. Some of these will be covered in articles to follow.

Chemistry of Water Treatment

Addenda to Part IV

On page 133 of the April issue of *Water & Sewage Works* there appeared Part IV of a series of articles on the Chemistry of Water Treatment by Dr. A. P. Black, Prof. of Chemistry at the Univ. of Florida.

Since publication of Part IV on the "Determination of pH Values," Dr. Black has called our attention to an omission on his part of reference to McCrumb's method for determining pH values of unbuffered solutions. Dr. Black writes:

"In the discussion of the determination of the pH value of unbuffered waters, it was pointed out on p. 135 that a convenient method of determining the buffer capacity of the solution consists of adding increasing volumes of indicator to the same volume of sample. If, by using this procedure, no change in pH is observed, the sample may be considered to be well buffered. If, on the other hand, the pH of the solution is changed by the addition of increasing volumes of indicator, then the solution may be considered to be only slightly buffered and precautions are indicated. This thought might well have been carried to its logical conclusion, and the fact pointed out that by use of decreasing amounts of indicator, the error in unbuffered solutions may be minimized or eliminated altogether. There is, at the present time, at least one colorimeter on the market employing this principle. This was pointed out by McCrumb in a note published in *Water and Sewage Works*, **92**, 344, 1945."

Lloyd Clark is Not Jerome Svore

Mixup in Pictures Our Error

In our report on the A.S.C.E. Sanitary Engineering Division Meeting, published on page 149 of our April number, we carried pictures of several

L. K. Clark

Jerome Svore

of the programmers, one of whom was L. K. Clark, Proj. Manager, Assn. of American Railroads, Baltimore, Md. Mr. Clark *was* one of the programmers, but the picture which appeared above his name was that of Jerome Svore, State Sanitary Engineer of North Dakota. Mr. Svore replaced Mr. Clark when the latter accepted the position of Project Manager on the problems of railroad sanitation for the A.A.R. in early 1946. At that time we ran a story about Mr. Clark and Mr. Svore, with Mr. Svore's picture, the cut of which was incorrectly tagged L. K. Clark in our files.

We hope that both Mr. Clark and Mr. Svore can understand that with the wrong label on the cut proof of the picture it was an easy matter to use the wrong picture. At any rate here are the pictures of the two men, correctly identified.—We hope!

N. Y. City Sewage Disposal Program Underway

In accordance with an order of the Interstate Sanitation Commission, a program for sewage disposal at New York City is now underway and according to recent information is seven per cent complete.

The program contemplates that by the end of 1953 no raw sewage will be discharged into Class A waters, and work will have begun on removal of waste from Class B waters. This latter part of the program is expected to be completed by 1958. The total program will cost $94,830,000 for the first five years. To date contracts costing $6,201,320 have been completed. Some of these were started a number of months before the order was issued.

One plant soon to be completed is the Twenty-Sixth Ward Sewage Treatment Works in Brooklyn, costing $9,240,000. This plant will treat 60 mgd. from an area of 5,800 populated acres.

The next contract to be let will be for the Hunts' Point Sewage Treatment Works at a cost of $25,000,000 to serve a population of 770,000 in the East Bronx where the flow is expected to be 120 mgd.

NEW JERSEY SEWAGE WORKS ASSN. 34TH ANNUAL MEETING

Record Attendance Drawn by Varied Program

THE 34th Annual Meeting of the New Jersey Sewage Works Assn., held in Trenton, N. J., March 23-25, had a record attendance of 361, and the famous speechless

President
Leslie West
Chief Engr.
Joint Meeting
Elizabeth, N.J.

Vice-Pres.
John Struss
Supt.
Sewage Works
Wildwood, N.J.

dinner drew more than 300 persons. This was a record far exceeding any previous year for both total attendance and number attending the banquet. Undoubtedly it was the very interesting program which drew this large number of registrants. One session was devoted to industrial waste treatment, another to sewer authorities and still another to general topics.

INDUSTRIAL WASTES

The first session of the meeting was presided over by Leslie West, Supt., Elizabeth Joint Meeting Sewage Treatment Works.

Fine Chemical Wastes

"THE WASTE DISPOSAL PRACTICES OF A FINE CHEMICAL MANUFACTURING PLANT" was the title of the paper presented by D. J. Cestoni, Plant Waste Disposal Engineer, Merck and Co. Inc., Rahway, N. J.

Mr. Cestoni referred to the wide variation in types and quantities of waste from the fine chemical manufacturing plants and pointed out that they had liquid, solid, and gaseous wastes under their jurisdiction. Liquid wastes are largely acid, of varying concentrations. There is approximately a 2.2 mgd. flow to be treated in the waste treatment plants, which consist of an equalizing tank with a 10-minute detention period, a liming tank of 10-minute detention period, followed by another equalizing tank of 5-minute period. This is followed by a settling basin.

Dolomitic Lime is used to reduce the amount of sludge and the control of the pH is held to approximately 5.5 in the first tank and 6.0 in the final tank. There is also kept handy a standby quantity of 50 per cent sodium hydroxide for addition to the last equalizing tank, in case slugs of acid get by the operator. Glass electrodes are used in the various tanks to record the pH in order to improve control of the neutralization.

The waste disposal engineer must be familiar with the production schedules in all departments and must watch for specific wastes, in order to dole out acid wastes to neutralize alkaline wastes insofar as possible. Hot liquid wastes are another problem, as are flammable solvents which are kept out of the sewers. One means of educating the production departments is to charge each department for the amount of neutralization required for their wastes. In this manner, operating departments fully realize the extent of the losses from their sections.

Flammable wastes are burned in a special incinerator, but as a check, a recording is made of the flammable condition at the effluent and daily checks are made by portable devices at 21 points in the plant.

Solid wastes are generally disposed of on land, but may be burned. Gaseous wastes are treated in various ways, some being absorbed in water and discharged to sewers; others treated by other methods. This is a problem of air pollution not completely related to the treatment of liquid wastes.

In answer to a question as to why the pH was neutralized only to 5.5, or 6.0, Mr. Cestoni replied that there was little difference in the amount of lime required to raise the pH to 7.0 and that the City of Rahway, into whose sewers the wastes go, required a pH maintained of 6.0.

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New Brunswick, N.J.

Secy.-Treas.
M. S. Kachorsky
Supt.
Water & Sewage
Manville, N.J.

Pennsylvania Pollution Control

F. B. Milligan, Division Engineer of Industrial Wastes, Department of Health, Commonwealth of Pennsylvania, spoke on "STREAM POLLUTION CONTROL IN PENNSYLVANIA." As an introduction to the explanation of the program policy of Pennsylvania's clean stream program, Mr. Milligan gave the definition of pollution as it is used in Pennsylvania. As an example of the results of the clean stream program, Mr. Milligan cited a heavy leather tannery, which polluted the stream to the extent that another industry below could not use the water. Cleaning up the one waste made possible increased production for the plant lower down the stream and at the same time increased the available trout stream areas.

Mr. Milligan explained the workings of the Sanitary Water Board of Pennsylvania, stating that it was not concerned with public water supplies, but rather with the pollution of surface supplies. Work on technical phases of the program is done by the Health Department personnel. Streams are classified as those requiring the complete treatment of waste before discharge, those requiring intermediate treatment, and those for which primary treatment alone is sufficient. Of 550 municipalities which have received notices to abate pollution, 90 per cent have engaged engineers and 63 have abated, or have approved plans for abatement. At

the same time, 650 industries have been ordered to abate pollution. One-half of these have employed engineers, 170 have plans under development. There are, in addition, some 3,000 mines of which 1,100 have approval for the discharge of waste.

Mr. Milligan referred to the difficulties of applying stream standards and pointed out that common sense was very important in such an application. The stage of the stream at which the standard is to be employed is important, and the minimum rate of flow must be determined.

The board action to date has been to classify streams as to character and use of water. This classification is subject to revision. Secondly, minimum requirements are set for each class of stream and thirdly, studies of streams are inaugurated after the minimum requirements have been met. This latter is a big job.

There is hope of setting effluent standards for different types of industries. Where feasible, these standards will be established on the basis of unit productions. Work is now going on in the steel industry and the pulp and paper industry in the collection of data as to the qualities and quantities of waste, in order to help develop the standards for these industries.

Acid mine wastes is one of the biggest problems in the State of Pennsylvania. Three million dollars have been appropriated for mine sealing. Several of the streams are being cleaned up, both from the point of view of dredging silt, (coal culm) and from keeping it out of the streams from now on. Some six or seven years ago a survey indicated about five million tons of coal silt per year were discharged into the streams. This has been materially reduced as of today.

The State of Pennsylvania is giving financial aid to cities or industries, for the study of waste treatment, where no treatment for a particular waste is now known.

In concluding his talk, Mr. Milligan spoke on the use of certain types of Save-All equipment in paper mills and of treatment of cyanides and cannery wastes.

Industrial Wastes

D. J. Cestoni
Engineer
Waste Disposal
Merck & Co.

Peter Homack
San. Engr.
Elson T. Killam
New York

Industrial Waste and the Consulting Engineer

Speaking on the "CONSULTING ENGINEER'S PLACE IN THE INDUSTRIAL WASTE PROBLEM," Peter Homack, Sanitary Engineer, Office of Elston E. Killam, Hydraulic and Sanitary Engineer, New York City, said that the industrial waste problem was of vital importance to the nation, and the solution of this problem would have been farther along, except for the slowing down effects of the war years.

In approaching the problem of stream pollution, Mr. Homack said that either one can eliminate the waste, grade the receiving water, or develop waste treatment processes. As to why waste should be treated, Mr. Homack pointed to the increased load on water facilities, damage to land owners, decrease in recreational value of waters, and the deterioration of water quality for industry.

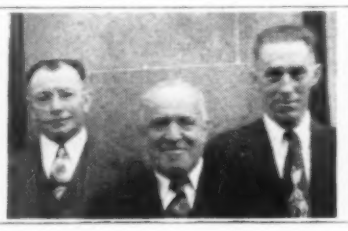
Industrial waste problems are individual and depend on the industry in question. Since industries are continually adding new processes, there may be expected to be a continual addition of waste treatment processes. In order to obtain a solution to any problem, Mr. Homack recommends a thorough study and classification of the wastes into those which can be treated with by-product recovery and those where no by-product recovery is possible. Sometimes by-product recovery results in lowering cost of treatment, although it will not pay for itself.

Among the possible methods of treatment, Mr. Homack suggested discharge of the waste to city sewers, or pretreatment of the waste before discharge. If this is not feasible, each case should be studied on its own merits, and before the industry begins its work it should consult with the Health Department and employ sanitary engineering chemists to make complete records.

In approaching the problem of industrial waste treatment, costs of treatment should always be kept in mind. Pilot plants should be tried out first, as they may show that final plans can be smaller than were indicated by early estimates. The consulting engineer's job in such a study is to correlate the whole project and to make possible future expansions. The consulting engineer's job is further to provide service to both the government and the industry.

The Manufacturers Speak

A short session in which "The Manufacturers Speak" was arranged by Arthur T. Clark, Secretary-Manager, Water and Sewage Works Manufacturers Assn. Inc., New York City. Appearing first on the program was JOHN J. HORGAN, Sales Manager, the Ralph B. Carter Co. at Hackensack, N. J. Mr. Horgan spoke about the R. B. Carter leveling flange for rotary distributors. By means of diagrams and discussions, Mr. Horgan pointed out that this leveling unit was an integral part of the center column and could be used to relevel the distributor arms in case of bed settlement causing misalignment. Without such a device, it is necessary to dismantle the entire distributor and relevel, but with the Carter flange it is possible, by simple adjustment of



Wm. T. McGill
Ass't City Engr.
Englewood, N.J.

Chester A. Duree
Plant Operator
Englewood, N.J.

Edw. Lawlor
Supt.
Little Falls, N.J.

Robt. Shaw
Supt.
W. Paterson, N.J.

Clarence Clendenny
Supt.
Westwood, N. J.

Frank Mowrey
Supt.
Barrington, N.J.

Raymond G. Case
Supt.
Merchantville, N.J.

Thos. H. Weatherby
Supt.
Oaklyn, N.J.

Prof. E. J. Corson
Camden Vocational School
Camden, N.J.

leveling screws, to bring about the realignment.

The second speaker on this session was W. T. PATRICK of the Warsop Tool Co., Philadelphia. Mr. Patrick spoke about the portable gasoline, self-contained paving breaker. This is a unit which weighs but 90 lbs., and is driven by compression from the hammer with single cylinder gasoline engine. A flexible exhaust can be attached for inside work. It is worked off of the knee. It is an English machine, which is assembled at Philadelphia, Pa., but service is complete throughout the country.

Sewage Chlorination

"CONTROL OF BACTERIAL NUMBERS IN CHLORINATED SEWAGE EFFLUENTS" was the topic presented by Rolf Eliassen and Herman L. Krieger, Professor of Sanitary Engineering and Research Assistant, respectively, College of Engineering, New York University, New York.

Professor Eliassen said that the purpose of this study was to tie together some loose ends, in order to give the operator a control tool, as a means of producing good operation at economical cost. The results were obtained at Ridgewood, N. J.

By means of graphic presentations, Professor Eliassen showed that the chlorine residual holds up with time, after the demand has been satisfied in an ordinary domestic sewage. Bacteria are killed in a short time with high residuals, and a longer time with lower residuals. In other words, the same kill can be obtained with less chlorine, if higher contact time is available. The effect of contact time on the rate of kill is great, but the effect of contact time on the chlorine residual is small. 30 minutes' contact time is more than is generally needed, if the chlorine residual is kept at approximately 0.2 part per million.

In discussing this paper, LINN H. ENSLOW, Editor, *Water and Sewage Works*, pointed out that Professor Eliassen's studies confirmed the similar data collected in 1926 at Huntington, L. I., by Enslow and Tiedeman.

Plainfield Administration of Sewage System

Mr. Joseph D'Agostino, Councilman of Plainfield, N. J., and a consulting engineer, but not in the sanitary engineering field, told how "PLAINFIELD TAKES A FORWARD STEP IN THE ADMINISTRATION OF SEWAGE SYSTEMS." In reviewing the history of the improvement of the sewage works of the Plainfield plants, Mr. D'Agostino pointed out that during the growth of the city the improvements were put off with the result that the delay meant sudden big expenditures facing the city all at once. Because of a ban by the Health Department in January, 1948, and the objection of neighboring communities to the odors from the sewage plant, Plainfield was faced with expansion of their plant.

Executive Comm. Members
(Past-Presidents Both)

H. Van der Vliet
Supt.
Sewage Trtmnt.
Maywood, N.J.

L. J. Fontenelli
Supt.
Joint Meeting
Rahway, N.J.

Among the causes of odors were stale sewage, mal-functioning of the primary tank, and poor condition of the trickling filter and sludge drying.

To combat these odor conditions, a new smoke stack was built, along with other improvements, and one industrial waste was removed from discharge into the sewers, because it was found that this waste was causing a breakdown of the filters. Stale sewage was found to be caused by growths and sedimentation in the sewers. This was overcome by cleaning and by installing and repairing flushing units. As a result, neither chlorine nor cloroben have been used, although both are available as standbys in case stale sewage occurs.

Chlorine was used to clean up the trickling filter, and constant chemical analysis was installed to measure plant performance.

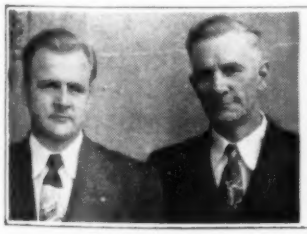
The second part of the program at Plainfield was the development of an ordinance to control waste. This was one of the strictest ordinances that has yet been passed in the city. It states that nothing but domestic sewage can be discharged into the sewers, unless by special permit for industrial waste and these wastes can be tested by the city and standards established for them and, if necessary, equalizing or pretreatment must be used. The rate of payment is based on the character of the flow and the contents.

In addition, the ordinance provides that there can be no garbage from home garbage grinders discharged into the city sewer system. In reference to garbage grinders, Mr. D'Agostino said that it was necessary to inform the public of the reason why garbage grinders could not be used, and that if the people then wanted to pay for a construction of increased treatment plants and facilities to take care of the increased load from garbage grinders, the ordinance could be changed accordingly.

Ground Garbage at Greenwich

"HOW GROUND GARBAGE IS EXPECTED TO INFLUENCE SEWAGE WORKS AT GREENWICH, CONN.," was explained by Joseph Doman, Sanitary Engineer, Department of Public Works, Greenwich, Conn. It is very obvious from the report that Greenwich should not accept ground garbage. This decision was based on the present situation and the future attitude of the Connecticut Health Department Water Pollution Commission and the Interstate Sanitation Commission.

At the present time there are four old plants at Greenwich, two of which have been remodeled somewhat. Two are of the septic tank type. As a result of the conditions of these overloaded tanks, which were built to serve a

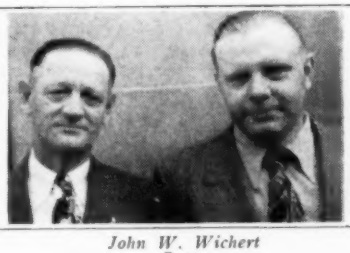


Herbert Struve
Ass't Operator
Raritan, N.J.

"Andy" Christensen
Chief Operator
Raritan, N.J.

James Davis
Operator
Collingswood, N.J.

J. W. Goodfellow
Operator
Somerdale, N.J.



John W. Wichert
Supt.
Butler, Pa.

Harold Eifler
Supt.
Totowa, N.J.

Frank Manning
Principal Engr.
and
Marshall Ferguson
Field Engr.
Interstate San. Comm
New York

small domestic population, and are now greatly overloaded, it is obvious that, for the present, no ground garbage can be accepted.

Mr. Doman concluded with the statement that no one should accept

Arrangements Chairmen

(For the Ass'n.)
Robert Shaw
Engineer
State Dept. Hlth.
Trenton, N.J.

(For Mfgrs.)
Arthur T. Clark
Secy-Mgr.
W. & S.W. Mfgrs.
New York

the situation existing at Greenwich as being applicable to other cities, but that for Greenwich no garbage grinders could be installed unless the people would provide funds to increase the treatment plant facilities.

This paper brought forth considerable discussion, most of which pointed to Mr. Doman's conclusion that conditions in Greenwich should not be applied to other cities. It was also pointed out that Mr. Doman had an excellent argument to go before his public for increasing treatment plant facilities, which certainly should be done, whether or not garbage grinders are installed.

Bergen County Sewer Authority

Donald A. Quarles, Vice President of the Bell Telephone Laboratories, Inc., and Chairman, Bergen County-Hackensack River Sanitary Sewer District Authority, described the "Organization of the Bergen County Sewer Authority."

He pointed out that of some 70 municipalities in the county 50 lie within the authority's district. Some of these 50 have good sewage treatment, some fair, some indifferent, and some none. Growth of the county has been rapid and outside of the bounds, making it obvious that individual plants are not the answer to the pollution problem in that county. The present authority is a postwar development that proposes a trunk-line sewer and a sewage treatment plant. In order to establish the authority, the state law had to be revised, and after two years' work the authority is now a going concern, which has a sound corporate structure but no customers. It is expected, however, that this will not be the case for long. Contracts are under way to construct and operate a single plant, to which the various municipalities will connect and pay. The charge per million gallons will be uniform, although there can be a surcharge for sewage of extra strength. It is expected that these contracts will be signed by the several municipalities and that work can then proceed. An interceptor will be built, to pick up the sewage at the present outflow. Financing will not be by revenue bond, but will depend on revenue collected from the cities. These municipalities are obligated to take their share of the pro-rated cost.

Ivan L. Bogert, Consulting Engineer of Clinton L. Bogert Associates, New York City, discussed the plans for the interceptor and the sewage treatment plant. There will be two pumping stations and a 60-inch sewer. There are two small siphons and two major stream crossings. It is planned to have a screen chamber, wet well, grit collector, primary tank, aeration tank, final tank, final chlorination, and an effluent sewer. Separate sludge digestion will be used and the sludge discharged to lagoons. The total capacity of the plant is 70 million gallons maximum as far as pumps are concerned, although it is expected that the average flow will be 20 million gallons with a peak flow of 45 mgd. Screenings will be buried and aeration will be by swing diffusers, with provision for tapered aeration with 25 per cent return sludge.

In answer to the question as to what will happen to present plants, it was stated that Tenafly, N. J., was the only good one existing today and that there would be no compensation to municipalities with present plants for an outmoded plant, if that municipality connects to this interceptor system.

Raritan Valley Trunk Sewer

George F. Smith, President of Johnson & Johnson, New Brunswick, N. J., and Chairman, Middlesex County Planning Board, discussed the "Proposed Raritan Valley Trunk Sewer and Treatment Works."

Tracing the history of this project back to the original report in 1930, Mr. Smith pointed out that industrial development at that time was expected to produce 17 mgd. of waste by 1954. Actually, in 1948, there were some 90 mgd. of industrial waste being discharged to the Raritan Valley. An engineering study of the problem indicated that to install separate treatment plants for the several municipalities and the several industries which discharge into the Raritan River would be quite expensive, as compared to the development or the construction of a 26-mile interceptor and the preliminary treatment works at the outflow. This study was made by the office of Elston T. Killam, consulting engineer of New York City.

Preliminary estimates indicate that the cost of the project will be twenty-six million dollars and the estimated cost of operating for a 40-year amortization will be one million two hundred thousand to one million four hundred thousand dollars a year. Nearly three-fourths of the load on this treatment works will be from industry which will pay for three-fourths of the cost of operation. Mr. Smith stated that industries had indicated their willingness to go along with the project, but a few cities were holding back at the present. He confidently expects that this situation will change and that the project will proceed within the next year or so.

Dr. Willem Rudolfs, Chairman, Department of Sanitation, Rutgers University, New Brunswick, N. J., discussed this paper by Mr. Smith. He pointed out that the river was worse now than in 1930, but that the bacterial content of the river was less than in 1930, because sewage treatment is being practiced by a number of municipalities. He, too, emphasized the fact that about 75 per cent of the waste going to the river is industrial, the total amount being approximately one hundred million gallons daily. A study of the individual wastes indicated that, when mixed, the wastes were much like domestic sewage, with a suspended solids content of 200 to 210 ppm. and a B.O.D. of 200 to 220 ppm., but the wastes were acid.

In order to overcome this acidity, it is found that mixing of the wastes provides the necessary neutralization. There are no odors but the sludge is large in volume. A removal of suspended solids of 90 to 95 per cent and a B.O.D. reduction of 25 to 30 per cent could be accomplished merely by mixing the wastes and allowing them to settle for a period of two hours. Some 1600 to 1900 tons a day of 5 per cent solids will be produced. This sludge will dewater well without the aid of chemicals.

Arrangements

Lou. Frazza
Johns-Manville Co.
New York

John Horgan
R. G. Carter Co.
Hackensack, N.J.

Laboratory studies indicate that it will be necessary to chlorinate the effluent for part of the year. The chlorine demand will amount to 18 to 25 ppm. If the wastes are discharged through a multiple discharge into the bay, it is expected that there will be little effect on the bay waters. The sludge produced will be of no value for fertilizer, because it has a high chemical content.

The results of the treatment will be to improve the river, decrease beach pollution, reduce the effects on fish life, eliminate the odors.

In answer to a question, it was stated that to take the waste to Sandy Hook would cost forty-five million dollars as against twenty-six million for a proposed out fall. The out fall will run two and one-half miles into the bay. The question still to be considered is what effect the withdrawal of the water and discharge some distance below will have on the encroachment of salt waters back into the river.

Sludge Digestion at Rahway Valley

L. J. Fontenelli, Supt. of Rahway Valley Joint Meeting, presented a paper on "TEN YEARS OF SLUDGE DIGESTION EXPERIENCE AT THE RAHWAY VALLEY SEWAGE TREATMENT PLANT." Mr. Fontenelli pointed out that there were 55 industries connected to the Rahway plant and that the wastes were relatively high in organic load. At a population of 75,000, the digester capacity is 2 cu. ft. per capita. Two of the digesters are primary stage with fixed cover and two are for secondary stage with floating cover. In addition to describing the early operating experience and difficulties with foaming, Mr. Fontenelli brought out the results of studies which showed the relationship between temperature and supernatant liquor removed. These studies showed that in increasing the temperature of the digestion tanks in the primary stage from 82 to 92 degrees, the amount of supernatant liquor removed decreased. Digestion of 83.3 per cent was obtained in the primary stage and 16.6 per cent in the secondary stage. The total solids in the digested sludge was increased to 10.8 per cent. There is a 50 per cent reduction in soluble matter, 17.3 cu. ft. of gas being given off per pound of all the matter destroyed.

Programmers

Joseph Doman
San. Engr.
Dept. of Pub. Wks.
Greenwich, Conn.

Rolf A. Eliassen
Prof. San. Eng.
N.Y. University
New York, N.Y.

Mr. Fontenelli said that a thorough mixing of the raw sludge received was essential. They discovered that by adding the sludge at the top and allowing it to work down through the digested sludge, better mixing was obtained and no short-circuiting of raw sludge direct to the sludge discharge resulted.

DR. WILLEM RUDOLFS, Chairman, Department of Sanitation, Rutgers University, New Brunswick, N. J., discussed Mr. Fontenelli's paper. He emphasized that the facts in the paper are fundamental for both operation and design. He pointed out that the important points brought out were that there must be a good solids-separation in sludge digestion and that this is as important as large gas production. It means increased digester capacity.

For two-stage digestion the digester capacity should be based on the primary tank, as the secondary tank is only a concentration tank. In reality, this means that there is only one stage of digestion, plus separation of liquor. For this reason, primary tanks should be larger and the secondary tank size should depend on the amount of separation of solids and liquor desired.

Another important point brought out was the temperature effect on the separation of liquor. At the higher rate of digestion, more solids can be handled, and, at the same time, better separation of liquor and solids obtained. Using the secondary stage as the dewatering device means that the drying beds can be smaller.

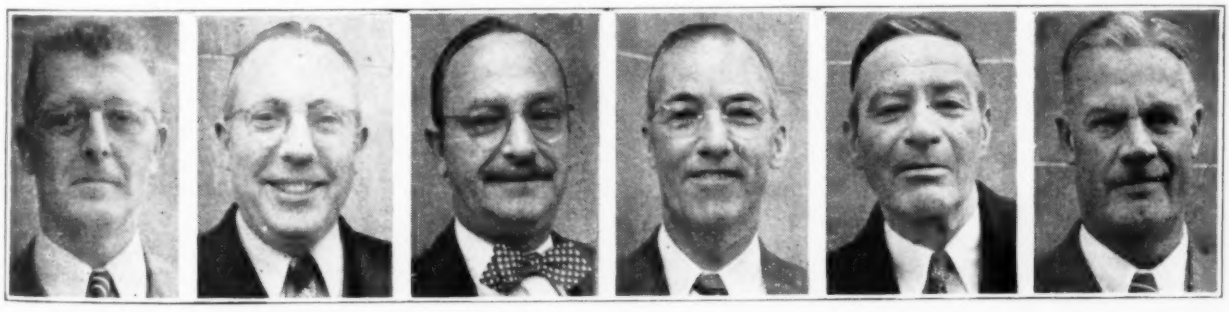
Dr. Rudolfs pointed out that most of the gas was evolved in twenty-four hours, the high rate giving a unique mixing device. But high rate digestion makes it difficult to separate liquor and solids. This, however, is accomplished by the second stage which is not heated by outside means.

Dr. Rudolfs emphasized the fact that these studies had shown that a loading of 5.5 lb. of dry solids per cu. ft. per month were possible at the higher temperature of digestion; whereas it was once thought that 3 lb. per cu. ft. per month was the maximum available. Thus, the use of the higher temperatures and good mixing of raw digested sludge has increased the capacity of the tanks by 40 per cent.

The Federation S.W.A.

A. H. NILES, Vice President of the Federation of Sewage Works Associations, and Engineer-Superintendent of the Department of Public Service of Toledo, Ohio, brought greetings from the Federation to the New Jersey Section. Mr. Niles discussed the change in the *Journal* to take place in January, 1950, when monthly publication begins; hence the need for increasing the dues. He also discussed the committee work of the Federation and its growth and emphasized the need for including industrial engineers in the association.

Following Mr. Niles' talk, the New Jersey Sewage Works Assn. voted to increase its dues next year to meet the requirements of the Federation.



*Paul E. Bardet**
Engineer
Jamaica Plant
New York City

C. H. Capen
Chief Engr.
No. Jersey Comm.
Wanaque, N.J.

Geo. B. Mebus
Cons. Engr.
Glenside, Pa.

John W. Hood
Supt.
Sewage Treatment
Ridgewood, N.J.

Walter Fairbrother
Plant Operator
Riverside, N.J.

*Sam Probasco***
City Engineer
Burlington, N.J.

*President, N.Y. State Sewage Wks. Assn.

**Past-President N.J. Sewage Wks. Assn.

TANNIN INTERFERENCE IN D. O. DETERMINATIONS

by
WALDRON D. SHEETS, CH. E.
Research Engineer
THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO

DISSOLVED oxygen cannot be determined, or even estimated, in aqueous solutions containing tannin, by either the Winkler method, or the Rideal-Stewart modification.

In both of these methods the final reaction in the preparation of the samples for titration results in the liberation of free iodine, theoretically directly proportional to the dissolved oxygen originally present in the solution under investigation. Tannin when present, even in quantities as low as 1 mg. per liter, will react with the iodine sufficiently to reduce the probable answer from an analytical determination to an underestimated guess.

Furthermore, it has been determined that if the sample under investigation is allowed to stand from 10 to 30 minutes during the settling of the precipitate prior to acidification, the iodide is also reduced. Upon standing for longer periods, it has been noted that the brown color of the manganic hydroxide precipitate will also disappear.

The Author

Soluble Coffee Waste Experiments

In the investigation of suitable methods of treating wastes of an industrial plant producing soluble coffee, interference was noted in the analytical determinations for dissolved oxygen. The coffee color could naturally be expected to interfere but other manifestations were more difficult to understand. For example, a sample taken from an experimental aeration unit, treated up to and including the acidification, was delayed for two or three hours before the titration could be made. Upon opening the sample bottle, the odor of hydrogen sulfide, not present at the time the sample was taken, was quite evident. Iodine is a disinfecting agent and, if present in the sample, should have prevented or delayed the formation of the hydrogen sulfide. It would appear, therefore, that something had taken the iodine out of the solution.

No dissolved oxygen could be found in samples from the experimental aeration unit, even though feeding of the fresh waste was halted for several days. The quantity of air used was higher than that required by a normal sewage, at all times. Through curiosity starch solution was added to a D. O. sample from the unit immediately after acidification. Surprisingly, the normal dark, greenish black cloud appeared. It survived for about 30 minutes and could not be reproduced by the addition of more starch.

To test the effect of the waste on iodine, a solution was prepared by adding a small quantity of tincture of iodine to distilled water and a measured volume of this solution was added to 100 ml. of the waste. The mixture was titrated immediately with 0.025N sodium thiosulfate. Of 2.4 ppm. of iodine added, 1.6 ppm. were accounted for by the titration. In a second identical sample no iodine was found after an interval of 20 minutes. Obviously, the waste had an iodine demand.

The wastes under investigation were a mixture of coffee and sanitary wastes, with a total flow of 20 to 25 gal. per min. The temperature of the coffee wastes was high, and mixing with the sanitary wastes resulted in temperatures of 90° to 150°F. The primary settling tank was too large, being a remodeled septic tank and having a detention period of 15 to 20 hours. The tank effluent was light to dark brown with a sharp, sour pungent odor. It was apparent that one or more of the constituents of the coffee, under the influence of the high temperatures, produced predominating effects not characteristic of a normal sewage. What are these constituents which might cause this interference with the D.O. determination?

What Coffee Contains

Coffee contains as the main constituents caffein, tannin, fats, and a sugar. A part of the caffein is lost in the roasting process as it sublimes at the temperatures normally used. The remainder of the caffein is readily extracted during the processing of the coffee. The tannin is less easily extracted and is found largely in the final liquor which is discharged to waste. (The fats apparently remain in the grounds for they are not apparent in either the coffee or the waste liquor.) The tannin of coffee is re-

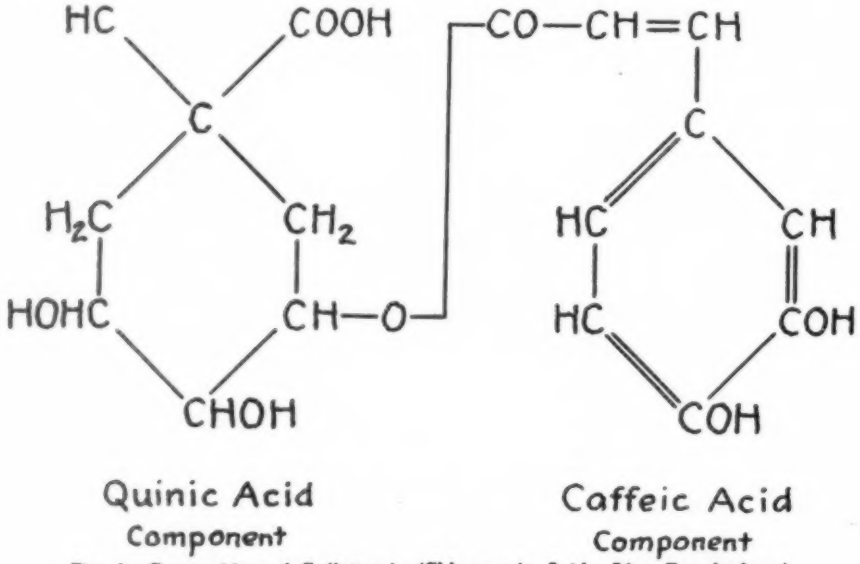


Fig. 1—Composition of Caffetannin (Chlorogenic Acid—After Freudenberg)

ported present in quantities from 4 to 9 per cent. It is called caffetannin after the general practice of adding a prefix to designate the source of the tannin. It appears as a likely suspect in this interference with the D.O. test, as will be shown later.

What Are Tannins?

Tannin is the term applied to a large class of somewhat heterogeneous compounds having the same general characteristics of an astringent taste, production of a blue-black or green coloration with ferric salts, precipitation by a solution of gelatin, by albumin and by alkaloids, and which unite with hide to form leather.

They were originally divided into two classes based upon the ferric salt reaction above, the blue-black's being the pyrogallol and the greens, the catechol. More recently, according to Thorpe[2], they have been reclassified into three classes; (a) the depsides, compounds analogous to peptides, (b) the ellagitannins, which contain the diphenyl methyloid group, and (c) the catechol tannins which yield phlobaphenes upon prolonged standing, or upon heating with dilute acids. Class (a) contain the pyrogallols, class (b) contains only a few members, among them the only synthetic produced so far, and class (c) includes the caffetannins.

Caffetannic acid is principally chlorogenic acid which in turn is easily broken down into two components, quinic and caffeic acids (See Fig. 1). Winton[1] disagrees with the term "caffetannic acid" and states . . . "although it gives some of the reactions of tannic acid, it does not precipitate albumin, gelatin or antipyrine, and therefore caffetannic acid is a misnomer". In view of the above description of the general characteristics of the tannins, and with respect to the behavior of the coffee wastes under study, caffetannic acid is correct in a general sense.

How Tannins React

Aqueous solutions of tannic acid are unstable, their decomposition being attributed to bacterial and mold growths, as well as to oxidation. Physical evidences of changes in such solutions include precipitation, darkening in color, and the development of an objectionable odor. The odor produced in the coffee wastes was previously described. Also in aqueous solutions, at a temperature not exceeding 50°C., tannic acid reacts with iodine.

The U.S. Dispensatory[4] briefly explains the tannin and iodine action as follows: "This reaction which is not clearly understood, was the basis of the N.F.V. Iodotannic Syrup." The 22nd Edition[3] however, gives a more detailed account—"When tannic acid, iodine and water are mixed, a reaction takes place by which the water is decomposed, its hydrogen forming with the iodine to make hydriodic acid, which combines with a portion of the tannic acid and remains in solution, while the oxygen of the water combines with another portion of the tannic acid to form a compound, which being insoluble is precipitated. The iodized solution thus obtained is capable of dissolving more iodine and holding it in solution, however much diluted. . . . Iodine in a liquid containing tannic acid cannot be detected by starch, but if the liquid is placed in a watch glass, ferrous sulfate added and the glass covered with starch paper, ferric tannate being precipitated, the blue color soon appears." Why this reaction is not described in the 24th Edition is not known, but for some reason, the more conservative statement was made, as above.

The National Formulary[5][6] presented the "Syrupus Iodotannicus" in which 2.7 grams of iodine are pulverized, and with 5.4 grams of tannic acid, is dissolved in distilled water and heated gently (under 50°C.) until a drop of the solution fails to give a blue color with starch.

These reactions would account for the iodine which could not be found in the earlier experiments described above.

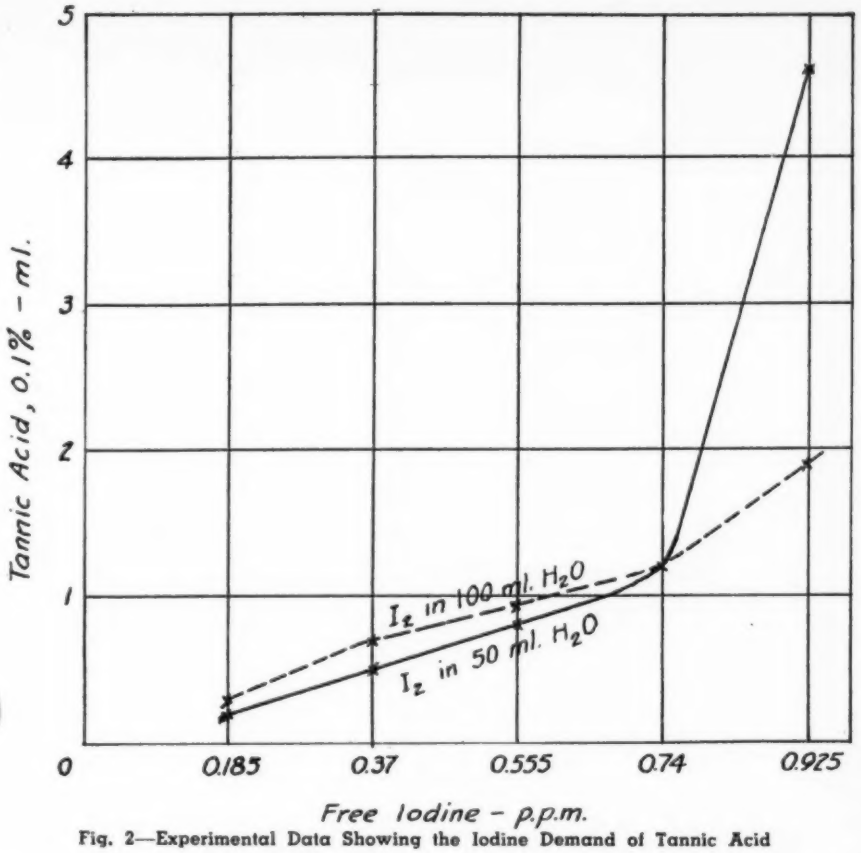


Fig. 2—Experimental Data Showing the Iodine Demand of Tannic Acid

Laboratory Check Tests

To further check the reaction, known quantities of iodine in distilled water were titrated with an 0.1 per cent tannic acid solution made from U.S.P. tannic acid and distilled water. Starch was used as the indicator and the end point the disappearance of the blue color. In the majority of titrations the blue disappeared and a light rose pink appeared. The blue did not return upon standing. The curves shown in Fig. 2 were obtained. The two curves show not only the iodine demand of tannins, but also the effect of dilution. A more dilute solution does not reach completion, or saturation, of the so-called iodotannic compound as quickly as a more concentrated mixture. Undoubtedly, a variety of concentrations would produce a family of curves, and since tannins are known of different molecular structures, it may be presumed that the curves would also vary with respect to the particular tannin under investigation.

With respect to the Rideal-Stewart modification, the standard 0.2N potassium permanganate solution was found far too weak to destroy the tannins. In addition, it was found that complete oxidation of the tannins was

not effected in 48 hours, even when a stronger solution was used.

Other Sources of Tannins

Tannins are found in almost all woody plants in varying quantities. They are obtained commercially from gall-nuts, the morbid excrescences found on several species of oak, and caused by the sting of an insect. Chinese gall-nuts produce 50 to 70 per cent of their weight as tannin. Black tea usually contains from 5 to 6 per cent, and green tea from about 12 to 15 per cent. The tannins may be found in the wood, bark, leaves, or fruit, varying according to the species of plant, and in almost any concentration.

Theriault and McNamee[7] found in their studies of sulfite liquors that other substances caused more interference than the sulfite liquor, but did not identify those substances as tannin. In discussing the Rideal-Stewart modification, they found that one volume of digester waste to 1000 volumes of water gave results 3 to 4 ppm. too low when the water contained 8 to 9 ppm. of oxygen. Further, in the alkaline-hypochlorite method, under step 6, they gave the warning, "The titration should not be delayed, as a measurable loss of iodine occurs on standing."

In conclusion, the effect of tannin interference is undoubtedly present in such wastes as the paper and pulp industry, tanning industry, and in boiler water treatment, and will seriously affect the determinations of dissolved oxygen and biochemical oxygen demand.

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2. Thorpe, Edward, "A Dictionary of Applied Chemistry", Vol. VI, 647-670, Longmans, Green & Co., Ltd. (1926)
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5. National Formulary, Fourth Edition, 1916 American Pharmaceutical Association
6. National Formulary, Fifth Edition, 1926 American Pharmaceutical Association
7. Theriault, E. J. and McNamee, P. D., "Dissolved Oxygen in the Presence of Organic Matter, Hypochlorites and Sulfite Wastes." *Ind. Eng. Chem.*, Anal. Ed., 4, 59 (1932)

W. S. Foster Becomes Vice Pres. A.P.W.A.

William S. Foster, Engineering Editor of *American City* Magazine has been elected Eastern Area Vice President of the American Public Works Association to fill the unexpired term of Edward J. Cleary, who moved from the Eastern Area to become Executive Director of the Ohio River Compact Commission at Cincinnati. Mr. Foster was previously Director-at-Large. Mr. Cleary was elected Director-at-Large to fill the vacancy created by the election of Mr. Foster as Vice President. He will serve in this capacity until the next regular election.

Ohio River Compact Commission Elects Officers for Coming Year

At the meeting of the Ohio River Compact Commission held in April, the Commission adopted the first standards for the River. These were the standards previously reported for the Cincinnati Pool, a 22-mile stretch between navigation dams 36 and 37. These standards which were the subject of a public hearing in February call for "substantially complete removal of suspended solids and 65 per cent reduction in B.O.D." from organic wastes discharged into the pool during periods of low flow.

The Commission held its meeting in Pittsburgh, following an inspection trip on the Allegheny and Monongahela Rivers. At the meeting, officers were elected for the ensuing year to take effect on July 1. In electing officers the policy was adopted to rotate the chairmanship among the several states. J. L. Quinn, Engineer, The Hulmand Co., Terre Haute, Ind., becomes Chairman for 1949-50. Other officers include Henry Ward, Conservation Commissioner of Kentucky, as Vice Chairman; F. H. Waring, Chief Engineer, Ohio Dept. of Health, as Secretary; Ralph Strotman of Cincinnati as Treasurer; Leonard Weakley of Taft, Stettinius, and Hollister, as Counsel; and Edward J. Cleary, Exec. Director and Chief Engineer.

L. W. Trager Heads New England Drainage Basin for U.S.P.H.S.

Asst. Sur. Gen. Mark D. Hollis, Chief of the Environmental Health Service of the Public Health Service, has announced the appointment of Leonard W. Trager as head of the New England Drainage Basin for the Division of Water Pollution Control. Mr. Trager will have his office at 120 Boylston St., Boston. This is the fourth office established in the proposed 14-river basin areas.

Mr. Trager, a native of Iowa, and a graduate of the Univ. of Iowa, has been with the New Hampshire State Department of Health since 1926, and has been director of the Division of Sanitary Engineering of that state. During the last war he served with the Allied Control Commission in Sicily, Sardinia, and Occupied Italy, and with the Military Govt. in France and Germany.

New Providence Borough Is In New Jersey

Not in Rhode Island

In our March issue on page 119 we had a short news item to the effect that the New Providence Borough Council had passed an amended sewer ordinance calling for a change in its regulations regarding house service connections. The new ordinance, which provides that house service connections shall consist of root-proof sewers, called for the use of "Transite" pipe or its equivalent, as well as cast-iron.

Although our story was correct, we incorrectly placed the Borough of New Providence in Rhode Island. Actually it is in New Jersey. We apologize to all concerned.

A Slight Mistake

And—somebody told my husband that *this* couldn't happen as long as our drinking water has so much chlorine in it.

YOU NEED BOTH HALVES OF THE SCISSOR

In the CHICAGO Comminutor the cutters and shear bars cut and chop; the channel feeds and holds.

The combination of channel and rotating drum makes the CHICAGO Comminutor the only effective method for cutting and screening sewage solids in the stream.

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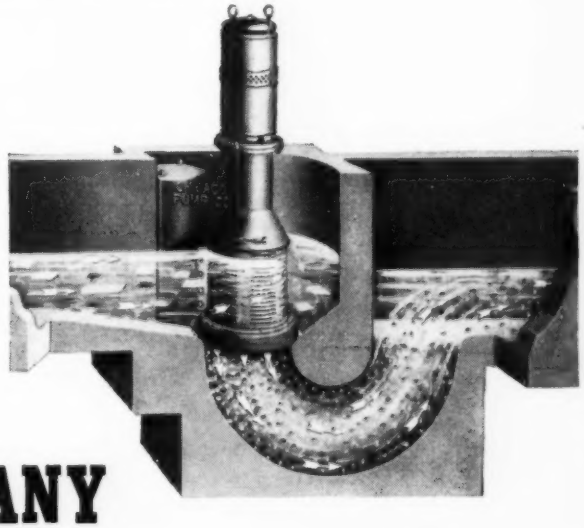

Cross section of a CHICAGO Comminutor channel illustrates a typical design of controlled discharge channel. Sheared small particles must pass through a maximum drum slot width of 3/8 in. Comminuted matter completely settles out in the primary tanks.

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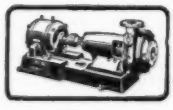

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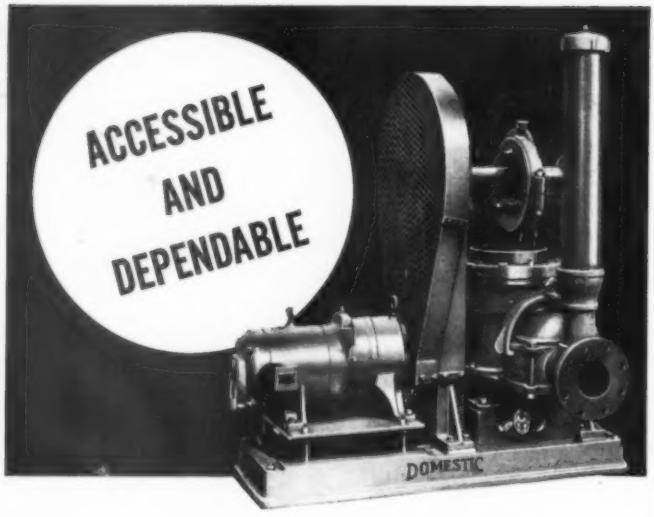

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MEETINGS SCHEDULED

JUNE 5-11—GAINESVILLE, FLA. (University of Florida)
Florida Short Course & Conference for Water & Sewage Plant Operators. Chairman, David B. Lee, Bureau of San. Eng., State Board of Health, Jacksonville, Fla.

JUNE 6-7—KINGSTON, N.Y. (Governor Clinton Hotel)
New York State Sewage Works Association. (Spring Meeting). Sec'y, Ralph C. Sweeney, State Dept. of Health, 19 E. Main St., Rochester 4, N.Y.

JUNE 9-11—TUSCALOOSA, ALA. (University of Alabama)
Alabama Water & Sewage Association & Short School. Sec'y-Treas., Prof. G. H. Dunstan, Univ. of Alabama, Tuscaloosa, Ala.

JUNE 13-17—STATE COLLEGE, PA.
2nd Annual Penna. Sewage Works School. Chairman, Prof. Robert E. Stiemke, School of Engineering, State College, Pa.

JUNE 15—WOODLAND, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Winthrop, Me.

JUNE 17-18—CHICAGO, ILL. (Hotel Sherman)
Central States Sewage Works Association. Sec'y-Treas., Paul W. Reed, 1098 W. Michigan St., Indianapolis, Ind.

JUNE 22-24—CLEVELAND, OHIO (Carter Hotel)
Ohio Sewage & Industrial Wastes Treatment Conference. Sec'y-Treas., G. A. Hall, 302 Dept. of State Bldg., Columbus, Ohio.

JUNE 23—WANAQUE, N. J.
New Jersey Section A.W.W.A. (Outing and Inspection) Sec'y, C. B. Tygert, P. O. Box 178, Newark, N.J.

JUNE 29—PORTSMOUTH, N.H. (Hotel Wentworth-by-the-Sea)
New England Water Works Association. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston 8, Mass.

JUNE 29-JULY 1—BATON ROUGE, LA. (La. State University)
12th Annual Louisiana Water & Sewage Short Course. Director, John H. O'Neill, Dept. of Health, Civil Courts Bldg., New Orleans, La.

AUG. 10—RANGELEY, ME.
Maine Water Utilities Assn. Sec'y, Earle A. Tarr, Winthrop, Me.

AUG. 22-24—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Association. Sec'y, I. M. Glace, 1001 North Front Street, Harrisburg, Pa.

AUG. 24-26—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Sewage & Industrial Wastes Association. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

SEPT. 6-7—COOPERSTOWN, N.Y. (Otesaga Hotel)
New York Section A.W.W.A. Sec'y, R. K. Blanchard, 50 West 50th Street, New York 20, N.Y.

SEPT. 8-9—MINNEAPOLIS, MINN. (Nicollet Hotel)
Minnesota Section A.W.W.A. Sec'y, R. M. Finch, 518 Metropolitan Life Bldg., Minneapolis, Minn.

SEPT. 13-16—DIXVILLE NOTCH, N.H. (The Balsams)
New England Water Works Association. Sec'y, Joseph C. Knox, 204 Tremont Bldg., Boston 8, Mass.

(*Continued on page* 76A)

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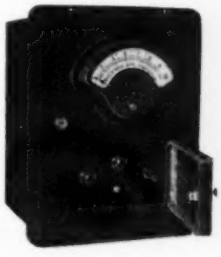

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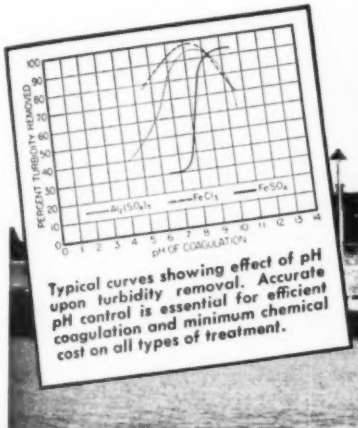

Typical curves showing effect of pH upon turbidity removal. Accurate pH control is essential for efficient coagulation and minimum chemical cost on all types of treatment.

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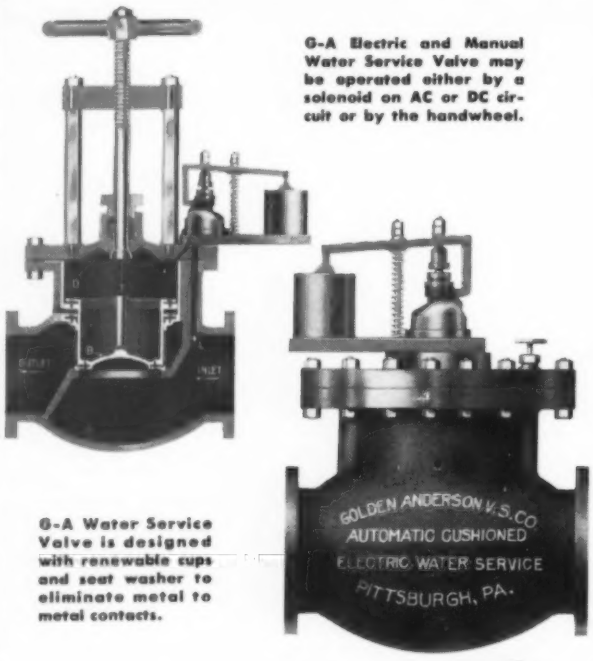

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MEETINGS SCHEDULED

SEPT. 14-16—HARRISBURG, PA. (Penn Harris Hotel)
Pennsylvania Section A.W.W.A. Sec'y, L. S. Morgan, 415 First National Bank Bldg., Greensburg, Pa.

SEPT. 20-22—DES MOINES, IOWA (Hotel Kirkwood)
Iowa Sewage Works Association. Sec'y-Treas., Leo Holtkamp, P.O. Box 310, Webster City, Iowa.

SEPT. 21-23—ATLANTA, GA. (Georgia Institute of Technology)
Georgia Water & Sewage School. Sec'y-Treas., Van P. Enloe, R.F.D. No. 5, Box 363, Atlanta, Ga.

SEPT. 21-23—WHEELING, W. VA. (Oglesby Park)
W. Virginia Industrial Wastes & Sewage Works Assn. Sec'y-Treas., R. G. McCall, Dept. of Health, Room 643, State Capitol, Charleston 5, W. Va.

SEPT. 22-23—COLORADO SPRINGS, COLO. (Acacia Hotel)
Rocky Mountain Section A.W.W.A. Sec'y, O. J. Ripple, 426 Cooper Bldg., Denver 2, Colo.

SEPT. 25-27—JOPLIN, MO. (Hotel Connor)
Missouri Section A.W.W.A. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

SEPT. 26-28—SCHUMACHER, ONTARIO (McIntyre Arena)
The Canadian Institute on Sewage & Sanitation. Sec'y-Treas., Dr. A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto, Ont.

SEPT. 28-30—TRAVERSE CITY, MICH. (Park Place Hotel)
Michigan Section A.W.W.A. Sec'y, Raymond J. Faust, State Dept. of Health, Lansing 4, Mich.

OCT. 3-4—DALLAS, TEXAS (Adolphus Hotel)
National Association of Corrosion Engineers. (South Central Region.) G. R. Olson, Chairman, Box 1407, Shreveport 92, La.

OCT. 6-7—BURLINGTON, IOWA (Burlington, Hotel)
Iowa Section A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

OCT. 9-12—OKLAHOMA CITY, OKLA. (Hotel Biltmore)
Southwest Section, A.W.W.A. Sec'y, L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

OCT. 11-13—MILWAUKEE, WIS. (Hotel Schroeder)
Wisconsin Section A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison 3, Wis.

OCT. 12—OLD TOWNE, ME.
Maine Water Utilities Assn. Sec'y, Earle A. Tarr, Winthrop, Me.

OCT. 17-19—PITTSBURGH, PA. (Hotel Wm. Penn.)
Engineers' Society of Western Penna. Chairman, H. M. Olson, Wm. Penn Hotel, Pittsburgh, Pa.

OCT. 17-20—BOSTON, MASS. (Statler Hotel)
Federation of Sewage Works Associations. Executive Secretary, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

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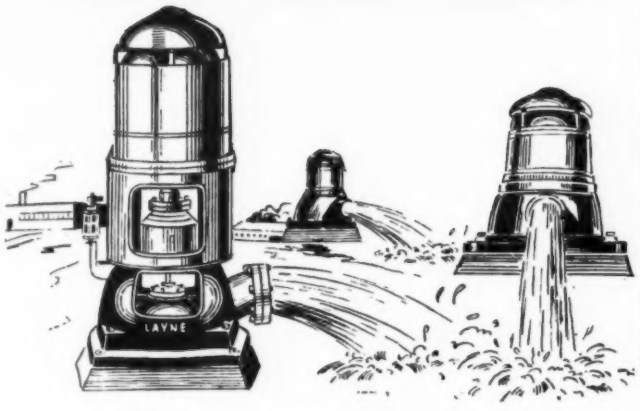

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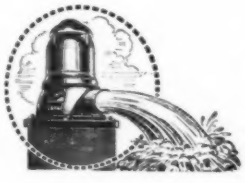

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How to beat a legal "threat" on WASTE DISPOSAL

With State after State now imposing legal restrictions on industrial waste disposal, you may be faced with this problem quite suddenly. Only by starting to gather complete data *now* can you be prepared for necessary action when the time comes.

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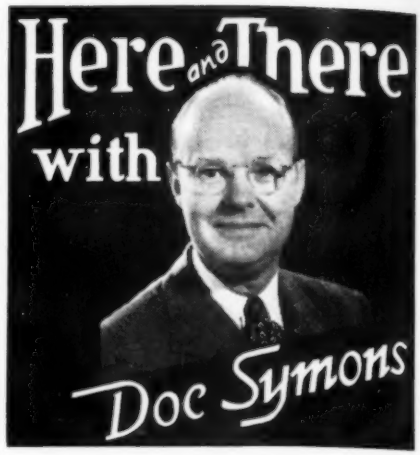

Here's **T**hat **M**an **A**gain—Yes, that is I, and with the new cut heading this month's column, the demise of my mustache becomes official. What with the shaving time cut five minutes, the extra sleep each morning comes in mighty handy.

* * *

You will be reading this column just about a day or two after the A.W.W.A. Convention in Chicago and considering that I am writing this a month before the convention begins, there is little I can say about it except—"Hope all of you enjoyed it". Come the August issue and I'll have something more to say about it; I hope, I hope, I hope.

* * *

Right now (as I write this) the thing uppermost in my mind is a little trip we (Gin, Jimmy, and I) took back home to Indiana and Illinois early in April. We drove, sampling the water supplies of a goodly number of communities. Our first overnight stop was at Wheeling, W. Va., where A. R. Todd makes a passable drink out of that mixture of sewage and industrial waste called the Ohio River.

All through Ohio, it was reassuring to see that F. H. Waring's boys had labeled all of the safe water wells along the route. Stopped overnight at Danville, Ill., where my Dad used to hold forth. Didn't get down to see Walter Clink, now Chief Engineer, but I'm looking for that story he promised me about electrifying the old plant where I broke into the water works game more than thirty years ago.

Our next stop was at Urbana-Champaign, home of the University of Illinois, and one of the last cities in the United States with an open sewer running through it. Runs right through the campus, too. The day I was there, the good townspeople voted to do something about

removed under pressure

This pipe section was cut, under pressure, from a 48″ main without shut-down or other interruption to service. The operation was performed in the course of inserting a gate valve in a 48″ cast iron main, in the distribution system of the Water Bureau, City of Philadelphia, Pa.

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30

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CORPORATION TAPPING MACHINES

that problem. Prof. Harold Babbitt showed me his sanitary engineering laboratory. Quite a wonderful improvement over the wooden sheds which housed the experimental plant when I was on the campus. They're doing some mighty interesting work there. And I was more than surprised to see H. F. Zaghloul, of Cairo, Egypt, whom I had met and photographed at the San Francisco Convention in 1947. At that time I tagged him as the registrant from the greatest distance.

Dr. A. M. Buswell of the Illinois State Water Survey, where I spent seven years of my collegiate life, was out of the city as was T. E. Larson and H. E. (Boone) Hudson. I did see Dean M. L. Enger, who told me a story about my late father. Also saw "Jimmy" Doland, Prof. of Civ. Engr., who gave my son "Jimmy" some good advice about studying that subject. Also spent some time with W. H. Wisely, now Exec. Secy. of the Federation, who was an engineering draftsman at the Survey when I first went there. Homer (Pete to you) and his charming family were delightful hosts. I have a hunch that it was the delicious pot roast which Hazel prepared that weakened my resistance to Pete's blandishments, and so I let him talk me into doing a job for the Federation.

Stopped off in Sullivan, Ill., to see John Winskill, who had sent me the dope on the combined operation of the water and sewage works of that city. (The article will soon appear in this magazine — Plug!) It was quite a surprise to discover that he was the same Winskill who had been janitor of the office building where I worked at the time I conducted the consumer survey in Sullivan. It was that survey which preceded the construction of the water softening and the sewage treatment plants there (another *Small World* incident).

Of course, I had to get over to Decatur to see W. D. (Hap) Hatfield, Supt. of Sewage Treatment, and my first mentor in the sewage treatment business. "Hap" and I did a bit of conversing on the progress of the 10th Edition of Standard Methods.

Purdue University was next on our list. Don Bloodgood (that young fellow with whom I was a freshman at the Univ. of Wisconsin) showed us around the campus. As we came out of Don's office, there was a young student waiting to see him.— And that was another *Small World* incident—Next evening I found that the student was Fred Van Kirk with whom I had arranged to have dinner at my fraternity house. Fred had just accepted a job with Chicago Pump Co. and will work with Miles Lamb. I also met Harvey Wilke, Don's new assistant. Ralph B. Wiley, Head of the Civil Engr. Dept., gave us some of his time and also some good advice to Jimmy.

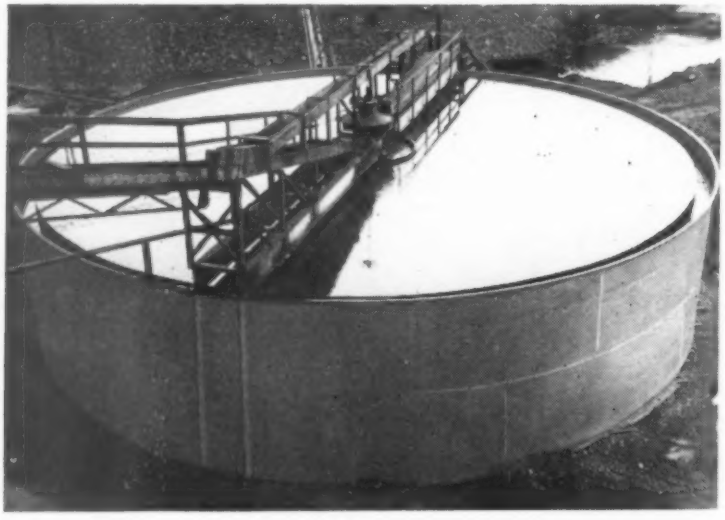
Next stop was Indianapolis, Ind., where the Ind. Section of A.W.W.A. was holding its 41st meeting. Had a lot of fun there acting as Master of Ceremonies at their Quiz Show. Alfred O. Norris, new Gen. Mgr. of the Indianapolis Water Co., was attending his first Indiana Section meeting. He'll like that crowd—and vice versa.

On the way home, we spent the night in Columbus, but we arrived late at night and left too early the next morning to give Charlie Hoover a call. (Sorry Charlie.) Came through Harry Krum's town, Allentown, but a hundred miles from home is no place to stop when one has been away for a couple of weeks. So-o-o I didn't even stop to try out some of that water Harry fixes.

HARDINGE CIRCULAR CLARIFIERS

for

WATER SUPPLY... WASTE WATER



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SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

The trip ended on Saturday night and on Monday morning it was back to Ulcer Gulch with a pile of work in front of me.

* * *

Small World No. 8!—At the Federation S.W.A. meeting in Detroit last October, two registrants were from Sweden.—Mr. & Mrs. Gullström. Also present were Mr. & Mrs. Harry (PFT) Schlenz, and Norma (Mrs. Schlenz) entertained Inga (Mrs. Gullström), among others, at lunch one noon. Conversation drifted to the next stop on the Gullström's travels, and Mrs. G. said she was planning on visiting "So-and-so," an old school chum who had been living in California for a number of years.

Norma got wide-eyed, and fairly gasped, "Did 'So-and-so' have a brother named Ed (or something) and did they live at such and such, etc.?" "Why, yes," said Mrs. G.—"Well, I used to date him—before I met Harry," replied Norma.—SMALL WORLD!

* * *

Remember when I told the story of the enterprising water works superintendent who found a new use for chlorine. He used a few well placed and well spaced whiffs of it to break up a crap game which had developed into a regular pastime outside his plant. I heard "Siggie" Sigworth tell the story, but couldn't remember the superintendent's name. Chas. (No. Jersey Water Dist.) Capen of Wanaque, N.J., says he was responsible for the story being brought to light at that meeting of the N.J. Section. Charlie also informs me that the superintendent is none other than Fred Luthy of Orange, N.J.

* * *

What will they think of next?—I cut this adv. by Bergdorf-Goodman, (one of New York's smart women's shops) out of the N.Y. Herald Tribune. Thought you might find it amusing!

Public utility suit of rayon shatkan over rayon jersey pants, united to give you an all-in-one for swimming and sunning. Wear it, with or without straps, in white coconut-brown, peacock-green or right royal blue. Sizes 10 to 16. From our fashion pool.

What Will They Think of Next? Hmm-m?

* * *

Incidentally, "Jim" Potter, of Charlotte, N.C., whose cards I advertised some months back, had that one in his collection. And if you sent in a Reader Service Card marked H-T-1 you got it. "Jim," who used to sell Calgon, and is now a manufacturers' representative, said that he had had 44 requests for those cards through my column, and they came from 23 states and 4 foreign countries.—And he added that "The way those requests continue to come in shows that *even* the back numbers of *W. & S.W.* are read."

* * *

Do you remember in March when I said that R. E. Sweeney, U.S. Pipe's New England Repr., had posed the question as to "what was the name of Paul Revere's horse." The only reply I had came from Dick Burr of the American Brass Co., Waterbury, Conn. Dick said that a number of

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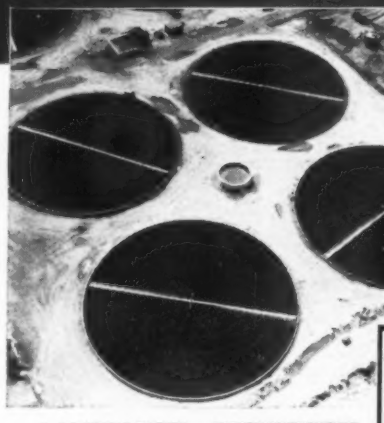

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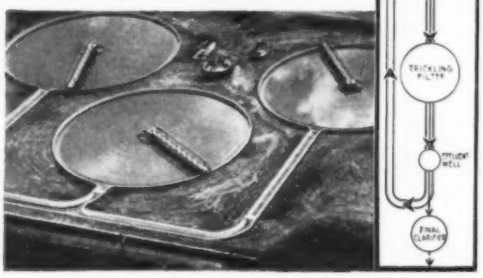

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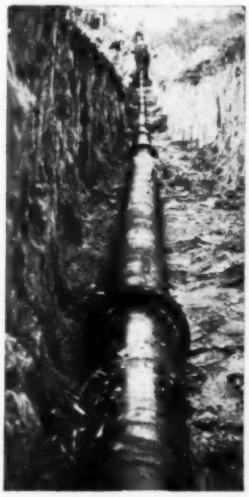

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years ago the Revere Copper and Brass Co. ran a series of ads calling attention to the fact that everyone remembered Paul but not his horse whose name was "Dobbin". I'll take your word for it, Dick.

* * *

A good many of my readers will remember Larry and Dorothy Lingnor, both of whom at one time worked on *Water & Sewage Works*. Larry was a space salesman in the Chicago Territory and Dorothy worked on circulation. After the war Larry left *W.&S.W.* to sell space for *Hardware World*, and now comes word that they have bought the Chemical Specialties Co. in Milwaukee, Wisc., and are returning to their old home town. Good luck, kids!

* * *

Last time I was in Toronto, visiting with the Ball's, the DeLaporte's, and the Galemberti's, I asked Helen Ball to turn her poetical talents to something about water. She did—that is, if you can call this poetry.

WATER!

Undoubtedly water
was made to use
for washing and swimming
and floating canoes.

In roadside puddles
it practically begs
to be used for
spattering nylon legs.

It's sensible, too
when your lawn's bone dry,
to have it come down
(free of charge) from the sky.

But say, is it true
there are "fellas" who think
that water (plus chlorine)
is "something to drink"?

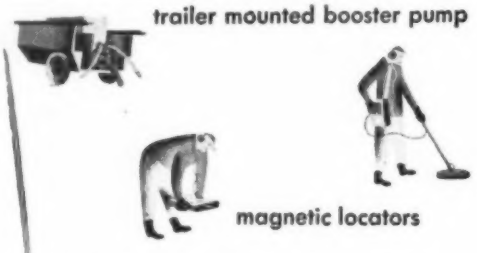
Helen Ball

* * *

And now let me be the first to wish you a pleasant Father's Day, a glorious Flag Day and a happy June Teenth.

V.T.Y.—Doc.

all this and radio too,



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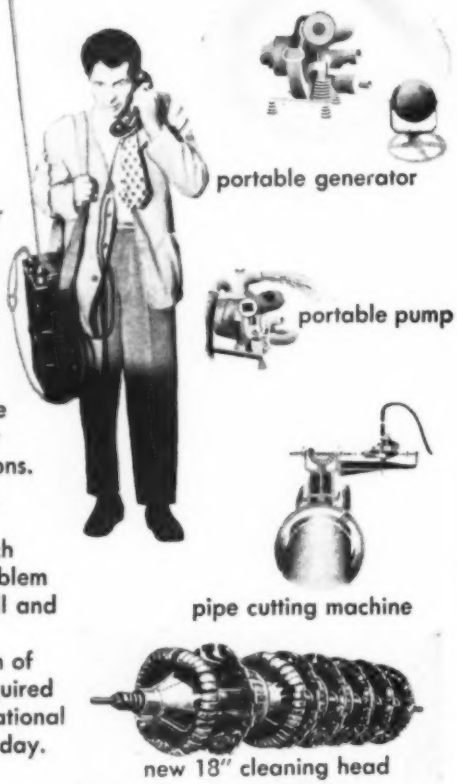

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[Overflow from the main section]

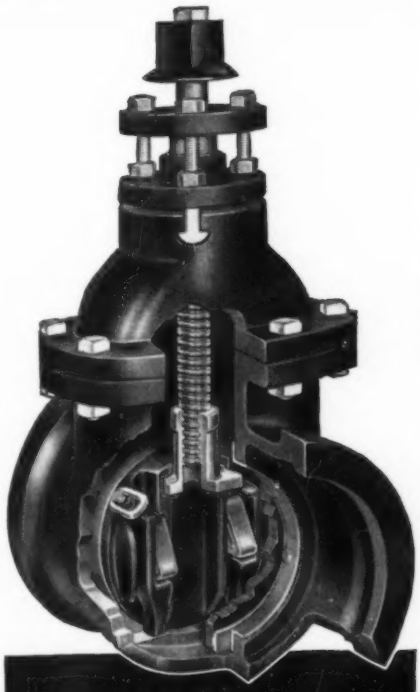
R. K. Horton Joins Ohio River Compact Commission

Robert K. Horton has been appointed sanitary engineer on the staff of the Ohio River Valley Water Sanitation Commission. Horton, a native

of North Carolina, comes to the commission following six years' service in South and Central America where he was engaged in directing sanitation programs sponsored by the U. S. Government through its Institute of Inter-American Affairs. During this four-year period he was a commissioned officer of the Sanitary Corps of the U. S. Army from which he was discharged with the rank of lieutenant-colonel.

Prior to entering the Army in 1942, Mr. Horton was a research fellow on stream pollution at the University of North Carolina, and from 1938 to 1940 he was employed by the Textile Foundation of Washington, D. C.

IOWA valves



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I.J.C. Technical Advisory Board Submits Interim Report

At the meeting of the International Joint Commission on Boundary Waters in Washington in April, the Board of Technical Advisors submitted an interim report on the study of the Lake Huron-Lake Erie section and the Lake Superior-Lake Huron section.

The primary recommendation of the Board is that continuing contact be maintained with the problem. The Board also recommended that the Commission formulate a water pollution abatement program for the St. Mary's River area and the Lake Huron to Lake Erie waters in consultation with Federal, State, Provincial and Municipal authorities. A third point in the recommendations was that remedial measures be brought about through existing pollution abatement authorities with active support of the Commission.

Two other recommendations were included in the interim report. The first that definite plans for financing remedial measures should be formulated with cooperation of all of the

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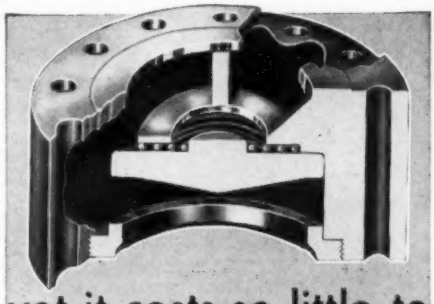

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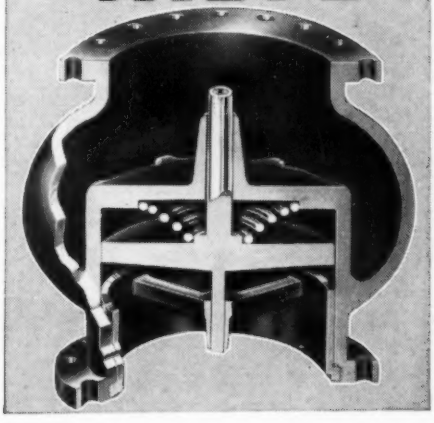

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above-named political subdivisions; the second, that supervision by the Commission in the future should be maintained through a Board consisting of at least one representative from the Dept. of National Health in Canada, the Province of Ontario, the U.S. P.H.S., and the State of Michigan.

According to the interim report, the field work which formed the foundation for the report included the collection of 26,212 samples of water and the making of 85,393 analytical tests in a two-year study which included 47 industrial plants in the U.S. and 20 in Canada as well as municipal water intakes, sewer outfalls, and bathing beaches.

L. M. Fisher, San. Engr. Dir., U.S. P.H.S., Washington, is Chairman of the Technical Advisory Board. Others on the Board are M. LeBosquet, also of the U.S.P.H.S., L. M. Oeming, and J. M. Hepler representing Michigan, Geo. Ferguson and W. R. Edmonds representing the Canadian Dept. of National Health and Welfare, and Dr. A. E. Berry and A. V. DeLaporte representing the Province of Ontario.

Water Metering

A little pamphlet on *Water Metering and Water Estimating*, written by C. M. McCord, Director of the Memphis Water Div., Memphis, Tenn., is now available again.

Nine editions of this small pamphlet were issued before the war, and the tenth edition has now been published in a new format. In this pamphlet, Mr. McCord explains with diagrams and language which the layman can understand the subject of water meters and estimating water flow.

To obtain a copy of this pamphlet, write to The Ambassador Co., Temple, Texas. Copies are available for distribution at a nominal price.

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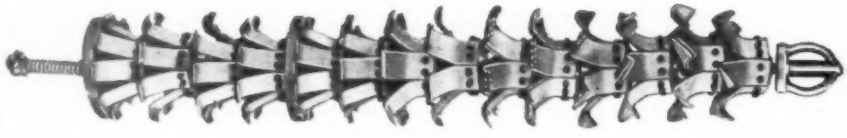

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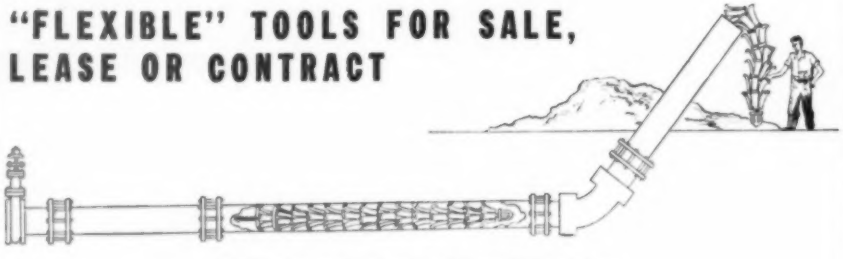

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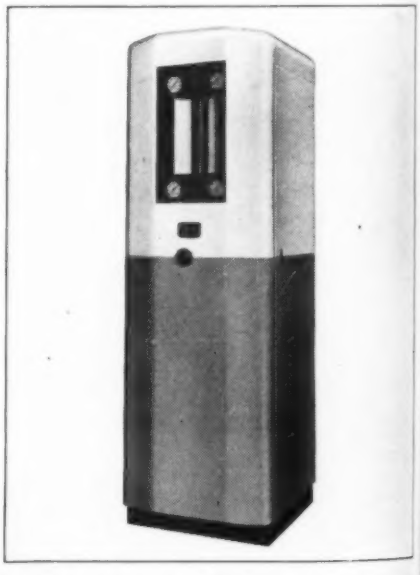
MANUFACTURERS' and EQUIPMENT NEWS

600

Chlorine Feeder

Builders-Providence, Inc., Providence, R.I., has just announced a new chlorine gas feeder. Known as the "Chlorinizer," the enclosed unit is designed to meter chlorine gas and produce chlorine water solutions. Special features insure safe and highly accurate operation. One of the features is a positive chlorine rate indicator with a direct reading linear scale. The



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For further information on this new unit, mail a Reader Service Card, on which is entered the above key number and your name and address.

E. L. Abramson Joins Aurora Pump

Ernest L. Abramson has become associated with Aurora Pump Co. of Aurora, Ill. A development engineer of twenty years' experience, Mr. Abramson will participate in the broad development program involving new designs, new sizes and new applications for Aurora Centrifugal and Apco Turbine-Type pumps.

FOR BETTER

pH Control and WATER TESTS

there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of technique, and compactness of the apparatus are exclusive features of Hellige Comparators.

WRITE FOR BULLETIN No. 602

HELLIGE

INCORPORATED

3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.

HEADQUARTERS FOR COLORIMETRIC APPARATUS

Goldak PIPE LOCATORS

FEATHERWEIGHT

MODEL 87

Weighs only 11 pounds

- Saves TIME and MONEY by Rapidly Locating Mains, Services and Stubs
- Fast, Easy One-Man Operation
- Low Operating Cost

WRITE FOR COMPLETE DETAILS

The GOLDAK Co.

1543 W. Glenoaks Blvd.

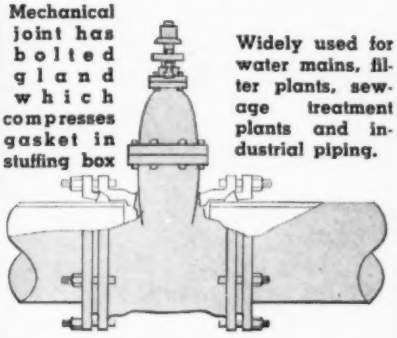
Glendale 1, California

Mechanical-Joint

HYDRANTS & VALVES

In addition to bell-and-spigot and flanged, we now offer M & H Valves and Hydrants with mechanical-joints for use with standardized mechanical-joint Cast Iron Pipe.

Mechanical joint has bolted gland which compresses gasket in stuffing box



Widely used for water mains, filter plants, sewage treatment plants and industrial piping.

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals.

M & H PRODUCTS INCLUDE

FIRE HYDRANTS	MUD VALVES
GATE VALVES	VALVE BOXES
TAPPING VALVES	FLAP VALVES
WALL CASTINGS	SLUDGE SHOES
SPECIAL CASTINGS	FLANGE AND
TAPPING SLEEVES	FLARE FITTINGS
CHECK VALVES	FLANGED
FLOOR STANDS	FITTINGS
EXTENSION STEMS	B & S FITTINGS
SHEAR GATES	CUTTING-IN TEES

M & H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

C. L. Morgan Becomes Associated With Dana Kepner

Dana Kepner, manufacturers' agent in Denver, Colo., has announced that Clifford L. Morgan, hydraulic and civil engineer, has joined the organization. Mr. Morgan has had considerable experience in the field of water and sewage treatment with the firms of Consoer, Townsend, and Assoc., Benham Engr. Co., Whitman, Requardt and Assoc., and Crocker and Ryan, as well as contracting experience. He will work with Mr. Kepner covering the states of Colorado, Wyoming, and New Mexico, specializing in water and sewage works equipment.

Alhydro Announces Distributors

Alhydro, Inc., 516 N. Charles St., Baltimore 1, Md., manufacturers of the Alhydro Floc Producer, has announced the appointment of the following distributors for the Alhydro unit: H. D. Fowler Co., Inc., P. O. Box 3084, 9th Ave., South & Lane St., Seattle 14, Wash., and General Filter Co., 923 Second St., Ames, Ia.

Lloyd Nelson Becomes President of Pontusco Corp.

According to an announcement by Gen. Donald Armstrong, President of the U.S. Pipe and Foundry Co., H. Lloyd Nelson, Eastern Sales Manager, has been granted a leave of absence to serve as President and Gen. Oper. manager of the Pontusco Corp.

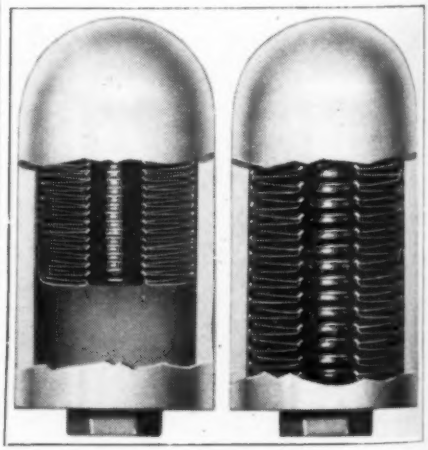
and the Pontusco Corp. of Cuba. The Pontusco Corp. is jointly owned by the U.S. Pipe and Fdry. Co. and the Compagnie de Pont-a Mousson of Nancy, France. It was formed in 1946 for the express purpose of manufacturing concrete pipe and associated products in North, Central, and parts of South America and Cuba.

Mr. Nelson has been associated with U.S. Pipe and Foundry Co. for 25 years. He has been active in the A.W.W.A., having served as a director, and as secretary of three different sections. He is a Fuller Awardee. Nelson is also a member of F.S.W.A., A.S.C.E., N.S.P.E., and other technical organizations.

601

Water Hammer Arrester

Wade Manufacturing Co. of Elgin, Ill. has developed a permanently sealed air chamber to eliminate damaging effects of water hammer in any industrial or domestic application.



Known by the tradename of "Shok-Stop," this device requires no servicing or maintenance after installation.

THE SUN NEVER SETS ON

% PROPORTIONEERS % Little Red Pump

%Proportioneers% Heavy Duty Midget Chem-O-Feeder — "The Little Red Pump" — is known and trusted in every corner of the world. To the Chinaman, African, and American alike it means safe, pure water. It handles the all-important jobs of water sterilization, taste and odor control, water softening, and dozens of other water treating applications. Because of its extremely simple, rugged construction, the Little Red Pump can be safely operated by almost anyone. It treats from a few gallons to a million gallons of water a day and feeds chemicals up to 7½ g.p.h. against pressures to 85 p.s.i. The chemical being fed shows plainly in the "See-Thru" plastic head and the action of the valves and diaphragm is clearly visible. Over 27,000 %Proportioneers% units right now are making this a healthier, better world to live in.

Write for Bulletin HDM-2

FEEDS . . .
Hypochlorite Solution
Hexametaphosphate
Alum Solution
Ferric Chloride
Soda Ash
Sodium Fluoride
and other water treating chemicals

% PROPORTIONEERS, INC. %
PROVIDENCE 1, R. I.

Bury it and Forget it!

EDDY DOUBLE GATE VALVE

Since 1849 EDDY For Long Service

If you will think before buying a valve—you can eliminate thinking of it forever after. When you think of valves—think of the years of time and effort we have put into giving you a smooth-operating, trouble-free valve. Think of the progressive water works men who have relied on Eddy Valves for years—then specify and insist on getting Eddy Valves—you can bury them and forget them.

EDDY VALVE COMPANY
WATERFORD NEW YORK

A subsidiary of James B. Clow & Sons

To obtain further information on this device, use a Reader Service Card on which is entered the above key number and your name and address.

J. R. Brown To Represent Flexible Underground in Chicago

James R. (Jim) Brown has resigned as Vice President in Charge of Sales Promotion and representative of the National Water Main Cleaning Co. in Chicago after nearly twenty years with the Company. Mr. Brown will henceforth be associated with the Trojan Tool Co., 141 West Jackson Boulevard, Chicago 4, Ill. Trojan Tool Co. is the exclusive distributor in the mid-west area for the Flexible Sewer-Rod Equipment Co. and the Flexible Underground Pipe Cleaning Co. of Los Angeles, Calif.

Peace of Mind

Operators of Roberts-equipped filtration plants have been telling us for years that our continuing interest in helping them keep their plants at peak efficiency, is a service on which they depend — from incidental replacement parts to million gallon per day additions.

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MANUFACTURING CO.
607 COLUMBIA AVE., DARBY, PA.

LEADITE
The Pioneer Self-Caulking Material for C.I. Pipe

TABLE OF COMPARATIVE QUANTITIES

Nominal inside dia. of pipe, in.	Depth of joint, inches of Leadite	Approx. lbs. of Leadite per joint	Depth of joint, inches of lead	Approx. lbs. of lead per joint
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

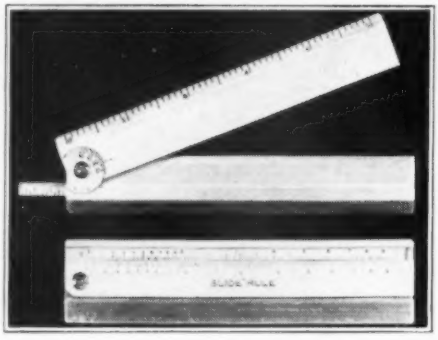
No Caulking

CARTER CARTER CARTER

602

Versi-Rule

Dall, Inc., 2409 University Ave., Minneapolis 14, Minn., has introduced a versatile engineering tool, known as the Versi-Rule. This handy pocket engineer is six tools in one. It is a slide rule, depth gage, beveled rule, protractor, triangle, and square. Made of light weight aluminum alloy construction, with durable finish, this unique rule is machine graduated with fractional and decimal scales, has beveled ruling edges, adjustable pivot friction joint, and raised inking edge.



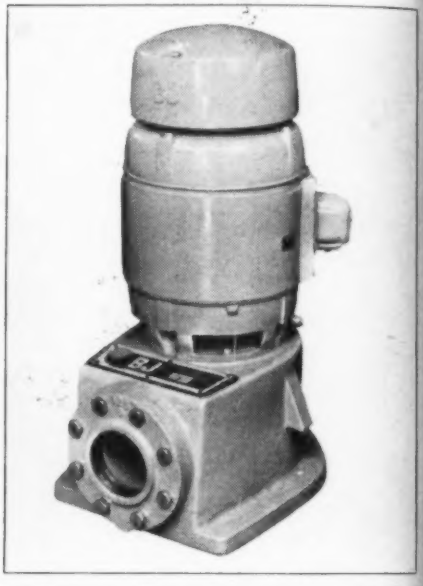
It operates with a T-Square, and all beveled edges lie flat for all positions of the rule. Size when closed 5⅜ x 1¼ x ⅛ in.

For further information about this new tool, use a Reader Service Card on which is entered the above key number and your name and address.

603

Deep Well Pumps

Byron-Jackson Co., Pump Div., Terminal Annex, Box 2017, Los Angeles 54, Calif., has just developed a new design for its deep well pumps. The latest design was worked out in collaboration with Henry Dreyfus, noted industrial designer.



This new line of pumps is available in several capacities, for widely varying well diameters and pumping heads. Several impeller designs are standard for each size in each of three bowl types.

For further information, use a Reader Service Card on which is entered the above key number and your name and address.

Price Reductions

Within recent weeks, three well known manufacturing companies have announced reductions in price for certain commodities. Dresser Mfg. Div. has announced reductions on two principal products, style 60 Bell-Joint Clamos, and Style 90 Super-Service Fittings. General Electric Co. has reduced the price on certain definite purpose fractional horsepower motors, particularly sump-pump motors, belt-drive fan motors, oil-burner motors, etc. U.S. Pipe and Foundry Co. of Burlington, N.J. has reduced its general selling price on cast iron pipe and fittings by $11 per net ton.

New Eastern Facilities For Peerless Pump Division On Huge Site At Indianapolis

INDIANAPOLIS, IND.—Peerless Pump Division's new Indianapolis works is the former Fall Creek Ordnance Works and was acquired both for its adaptability to Peerless' long studied and applied production line for manufacture of pumps and for its strategic geographical location for quick customer service. The existing plant, based on 50 ft. x 20 ft. steel column spacing was well adapted to the setting up for high manufacture volume of pump units. Approximately 261,000 square feet of floor space (6 acres under roof) is contained in the main manufacturing building. Auxiliary building for production control, shower and locker facilities for 1200 employees, main offices, dispensary, etc., adds many thousands of square footage. Included in the main building are 24 cranes of 2 and 5 tons capacity capable of operating the entire range of each of the six 50 foot bays. Spur tracks enter both north and south sides of main factory building. A complete and rounded complement of the most modern machinery has been assembled to build up one of the most accurate and finest industrial machine shops.

Newest pump factory in the U. S. geared to high speed production of horizontal and vertical pumps.

PEERLESS PUMP PLANT AT INDIANAPOLIS, IND.

19 ACRES OF MODERN PLANT FACILITIES DEVOTED EXCLUSIVELY TO MAKING PUMPS

Here is one of America's most modern pump factories. Peerless Pump's new plant at Indianapolis is devoted entirely to making pumps and handling pump service. All types of pumps in the Peerless line, horizontal centrifugal, deep well and close-coupled turbines, Underwriters' approved fire pumps and domestic water systems are made and serviced in this plant. No expense has been spared in tooling Peerless-Indianapolis to insure accurate pump production; testing facilities at Indianapolis are being incorporated into one of the largest pump laboratories in the country. Add these factors to sound basic Peerless pump designs, to the high caliber of Peerless personnel and to Peerless' extensive manufacturing facilities at Los Angeles, California, and they combine to make available as comprehensive pump service as is offered to pump owners and buyers anywhere. Peerless-Indianapolis is open for your inspection. You are cordially invited to see for yourself how Peerless-Indianapolis will exactly fit your needs for pumps and pump service.

Peerless
VERTICAL AND HORIZONTAL
Pumps

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Los Angeles 31, California Indianapolis, Indiana
District Offices: New York 5, 37 Wall Street; Chicago 40, 4554 North Broadway; *Atlanta Office:* Rutland Building, Decatur, Georgia; Omaha, Nebr., 4330 Leavenworth Street; Dallas 1, Texas; Fresno, Calif.; Los Angeles 31, California

REA
WA

READER SERVICE CARDS for

WATER & SEWAGE WORKS

Equipment — Products
Information — Literature

JUST
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WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

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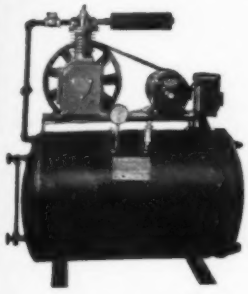

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APCO-V-APCO PRIMERS

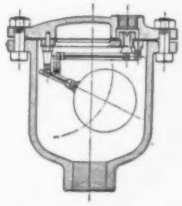
AUTOMATIC POWER OR TANK PRIMERS

AIR RELEASE VALVES

FOR

FILTER PIPE LINES—DISTRIBUTION LINES
AND OTHER USES

17 TYPES



No. 200 VALVE

VALVE AND PRIMER CORPORATION **127 N. Dearborn St., Chicago 2, Ill.**

Operating Management Changes at Mathieson

Mathieson Chemical Corp. has made several changes in operating management due to the increase in the number of plants resulting from recent acquisitions.

At a recent board of directors meeting, Dr. Carl F. Prutton was appointed vice president-director of operations of all the company's plants, and Arthur T. Bennett, vice president, was placed in charge of the eight plants acquired from the Southern Acid and Sulphur Co. R. B. Worthy and J. F. Newell were also named vice presidents.

C. F. Prutton

A. T. Bennett

Dr. Prutton has been director of research at Mathieson since joining the company in 1948. Prior to that time, he was head of the Dept. of Chemistry and Chemical Engineering at Case School of Applied Science.

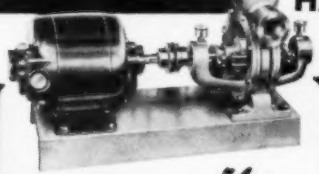
Mr. Bennett joined Mathieson as a technical assistant in 1933, and in 1946 was made vice president-manager of operations.

Mr. Worthy has been with Mathieson since 1925, starting as an assistant engineer at the Saltville plant. In 1943 he was made manager of the Saltville operations.

Mr. Newell came to Mathieson in 1931, and in 1944 became manager of the Lake Charles operations.

A SIZE AND A TYPE FOR EVERY LIQUIDS HANDLING JOB

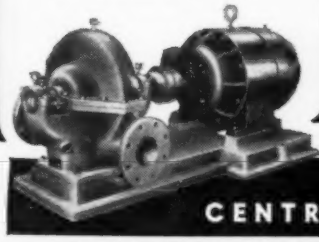
APCO TURBINE-TYPE



WATER SUPPLY
CIRCULATING
NON-CLOG
DRAINAGE
IRRIGATION
BOILER FEED
REFRIGERATION
SEWAGE
ETC.

MUNICIPAL
FARM & HOME
REFINERY
DISTILLERY
CORROSIVES
BOOSTER
COND. RETURN
ETC.

PUMPS "by Aurora" are the product of EXCLUSIVE BUILDERS of FINE pumps



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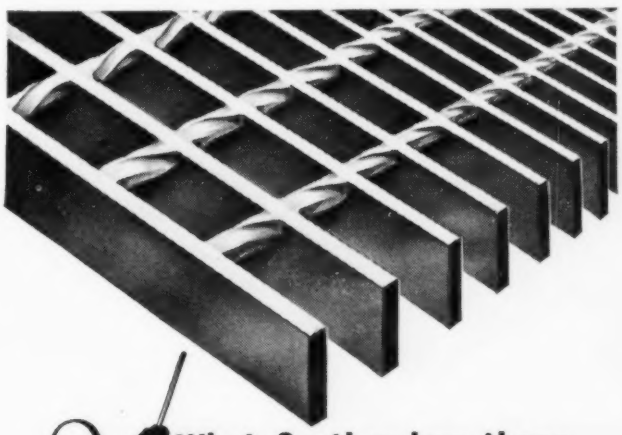
AURORA CENTRIFUGAL

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

Loucks St., AURORA, ILLINOIS



What Grating has these 5 important features?

1. One-piece electroforged construction develops the full strength of all sections.
2. Maximum Open Area for light and ventilation.
3. Easy to maintain . . . easy to paint thoroughly.
4. Self-Cleaning, no sharp angles to retain debris.
5. Safe footing at all times due to twisted cross bar.

BLAW-KNOX GRATING

BLAW-KNOX DIVISION OF BLAW-KNOX CO., 2051 FARMERS BANK BLDG., PITTSBURGH 22, PA.

J. F. Sanders Joins Neptune Meter

Announcement has been made that John F. Sanders, formerly superintendent of the water works at Boonville, Mo., has joined the sales force of the Neptune Meter Co. as a sales engineer and will travel the state of Missouri from headquarters located at 25 W. 15th St., N. Kansas City 16, Mo.

Mr. Sanders is chairman of the Missouri Section of A.W.W.A. and a member of the executive board of the Clear Streams Committee. He is also past chairman of the Missouri Water & Sewage Conference.

AT GRAND RAPIDS, MICH., the first city-wide tooth decay control project in America employs the OMEGA Loss-in-Weight Gravimetric Feeder to add sodium flouride to the city's water supply. Sponsors of this pioneer undertaking selected the Omega Feeder for its time-tested reliability and its extremely high accuracy. With positive rate adjustments, this feeder provides the close control of feeding needed to maintain correct flouride concentration for optimum tooth decay control.

The Loss-in-Weight Gravimetric Feeder, by feeding to an accuracy of 99% or better, performs a wide range of chemical treating and feeding operations in water works and sewage plants throughout the country. With the Omega Dust Collector, chemical feeding is dust-free as well as trouble-free — the perfect combination for modern plant operation. Descriptive bulletin on request.

OMEGA PRODUCTS
Volumetric Feeders
Gravimetric Feeders
Solution Feeders
Lime Slacking Equipment
Bucket Elevators
Laboratory Stirrers

THE LAST WORD IN FEEDERS
OMEGA

OMEGA MACHINE COMPANY
(Division of Builders Iron Foundry)
PROVIDENCE 1, R. I.

604

Large Rubber Packing Gaskets

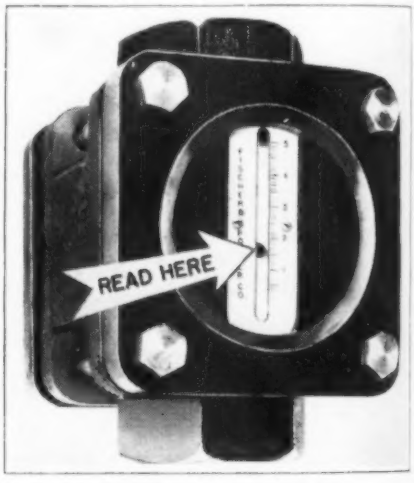
Northrop & Co., Inc., Spring Valley, N.Y., has announced that "Bond-O" Rubber Packing Gaskets for cast-iron pipe joints are now available in sizes for pipe up to 36 in. in diameter. These gaskets were formerly made for pipe from 4 to 14 in. only. Gaskets for pipe sizes larger than 36 in. can be manufactured to order, according to an announcement by the company.

For further information fill out a Reader Service Card and mail.

605

New Flow Guide

Fischer & Porter Co., Hatboro, Penna., has developed a new rate of flow indicator that is equally useful in clear or opaque streams. A unique adaptation of the area principle of flow measurement, the new "Magna-Sight" flow guide uses the company's standard Bull's Eye body with a fixed diameter at its vertical inlet. A tapered plug is suspended in the fluid stream within the orifice. There is a permanent magnet imbedded in the tapered plug which causes an external steel ball to move against a calibrated flow scale when increasing flow rate causes the plug to rise. Made in eight sizes from ¾ to 4 in. the flow guides measure maximum flow rates of from 3.5 to 250 gpm. Minimum flows are 1/10 of the maximum for each gage.



For further information on this item, fill out a Reader Service Card.

R. H. Gruner Joins Builders-Providence

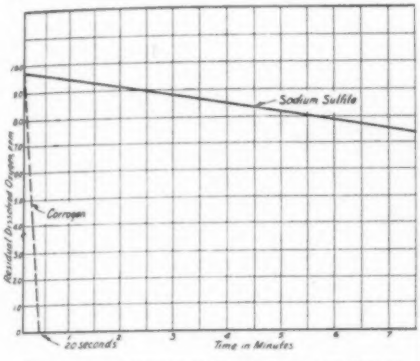
Builders-Providence, Inc., Providence, R.I., has announced the appointment of Rudolf H. Gruner to its New England office. Formerly with Brown

& Sharpe Mfg. Co. and Abrasive Machine Tool Co., Mr. Gruner will handle the sale of Meehanite castings and other Builders' products in the New England territory.

606

Corrosion Prevention

W. H. & L. D. Betz of Philadelphia 24, Pa., has announced a new development in the water conditioning field. Known as "Corrogen," this material is a catalyzed sodium sulfite and is offered for use in removal of dissolved oxygen, particularly in boiler water systems.



Comparison of Corrogen vs. Sodium Sulfite on Time of Oxygen Removal

The advantages of catalyzed sodium sulfite are shown in the accompanying diagram, which gives a comparison on the rates of removal of oxygen by "Corrogen" and by sodium sulfite.

For further information on this new development, use a Reader Service Card on which is entered the above key number and your name and address.

W. G. Carter Joins Buffalo Meter

Announcement has been made that William G. Carter, formerly with the industrial purchasing department of the National Gypsum Co., has joined the sales staff of the Buffalo Meter Co., Buffalo, N.Y., as assistant to Herbert F. Barrett, general sales manager.

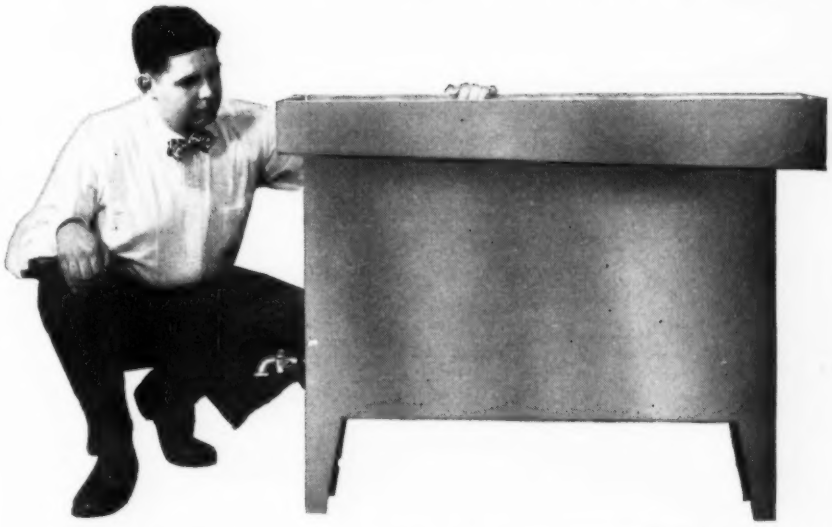
Mr. Carter will concentrate on the development of upstate New York markets and national industrial meter sales.

For Industrial And Municipal Water Treatment Plants

Alhydro FLOC PRODUCER

saves money 3 ways for

WATER PLANT OPERATORS



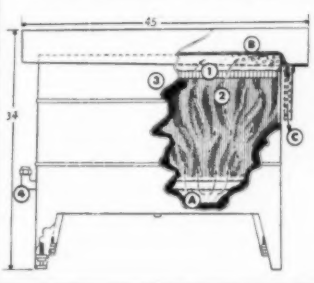
SMALL, COMPACT . . . *yet one unit treats an average of 300,000 gallons per day. Can be installed singly or in multiples. Produces floc by electrolytic decomposition of aluminum plates.*

SAVES ON CHEMICAL STORAGE PROBLEMS—in nearly every case, low-voltage direct current and aluminum plates are the only materials required to operate the Alhydro Floc Producer. Therefore, little storage space is required and there is no need at all for coagulant feeders.

SAVES ON FREIGHT AND HANDLING—since 69 lbs. of the easily replaceable aluminum plates treat nearly as much water as ¾ ton of ordinary coagulants, freight and handling costs dwindle to a minimum.

SAVES ON MAINTENANCE—the Alhydro unit requires only intermittent attention by one operator who controls the concentrations of aluminum hydroxide floc simply by setting the current volume.

. . . HERE'S HOW THE ALHYDRO FLOC PRODUCER OPERATES



1. Connector Bar on each side of tank.
2. Alternate Stainless Steel and Aluminum Plates.
3. Composition Rubber-Lined Stainless Steel Tank.
4. Water Feed Line easily removed for inspection.

a. Water enters tank through slots in feed pipe.

b. Concentrated floc is carried to top and leaves through discharge trough.

c. Discharge pipe feeds floc to raw water.

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See how Alhydro can save money by simplifying the treatment of water for drinking or industrial use. Write for your free copy today.

ALHYDRO, INC. DEPARTMENT 6B 516 N. CHARLES ST., BALTIMORE 1, MD.

Hooker Sales Changes

The Hooker Electrochemical Co. of Niagara Falls, N.Y., has announced the promotion of S. I. Anderson as assistant to the general sales manager with responsibilities both east and west in sales activities. Mr. Anderson has been with Hooker since 1933, previously as a mid-west representative and mid-west sales supervisor.

At the same time, T. H. Trimble was appointed eastern sales supervisor. Mr. Trimble has been with the company since 1934 and was previously a salesman in the territories of New York, Pennsylvania, and the southeastern seaboard states.

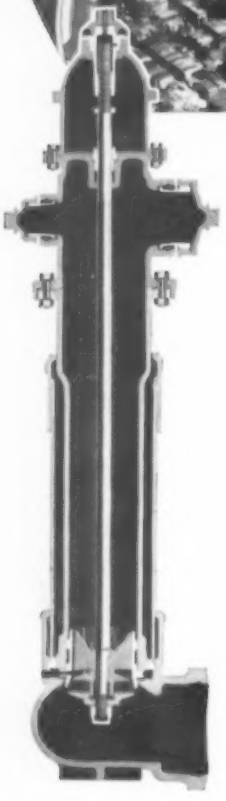
S. I. Anderson

T. H. Trimble

Neil M. Barber, who has been with Hooker since 1941 and a sales representative for New York State and western Pennsylvania since 1946, has been assigned to the area comprising eastern Pennsylvania and the southeastern seaboard states.

R. D. Greenway Joins Phila. Quartz

Philadelphia Quartz Co. has announced the appointment of Richard D. Greenway to its sales staff. Mr. Greenway will cover the territories of Maryland, Virginia and North Carolina. For the past five months he has been covering the eastern Pennsylvania territory.



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"One of America's Safest Cities"

THE MATHEWS FIREMEN SAY

Why do they say Camden is safe? Because it relies on Mathews Modernized Hydrants. And where there's Mathews, there's safety *plus*.

Mathews Hydrants are so simply and soundly designed there's virtually nothing that *can* go wrong with them. The operating nut is shielded from rain, dust and dirt. The main valve is true compression-type, opening *against* the water pressure. All the working parts are housed in a removable barrel which can be replaced in a matter of minutes, *without excavating*, if the hydrant happens to be knocked down by an out-of-control vehicle. There's no need for on-the-job repairs on a Mathews Hydrant.

Send for our illustrated booklet. You will see why city after city chooses the Mathews Modernized Hydrant as its best protection, and why *your* community should have the same advantage.

OTHER MATHEWS FEATURES: Head can be turned 360° • Replaceable head, nozzle outlets easily changed • Nozzle levels easily raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be oiled • A modern barrel makes any Mathews Hydrant good as new

MATHEWS HYDRANTS

***Made by* R. D. WOOD COMPANY**

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

LITERATURE AND CATALOGS

607
WATER & SEWAGE REFERENCE BOOKS

Gilbert Associates, Inc., Reading, Penna., has recently issued a revised edition of their **"Reference Bibliography for Water, Sewage, and Power Plant Engineering".** Containing 38 pages and multilithed on 8½ x 11-in. paper of good quality, this booklet is one that every engineer, chemist, manager, superintendent, or consultant in the field of water, sewage and industrial waste should have on his library shelf.

This booklet was prepared to present a source of reference on the use of water as a potable and feed water supply, sewage treatment, industrial waste treatment, power plant design and operation. Although no claim is made that the information is complete, these lists contain the titles, authors, and publishers of books on these subjects.

The following lists of books are included: Water Supply, Treatment, Treatment Plant Design & Operation Publications; Bacteriology of Water & Sewage; Sewage & Industrial Waste Treatment; Chemistry & Analysis of Water and Sewage; Power Station Design, Operation & Equipment; Engineering Handbooks, and Aids for Hydraulics & Power Engineering; Foreign Publications on Water, Sewage & Power Engineering; Periodicals on Chemical Laboratory; Periodicals on Pow-

er Station Operation; Periodicals on Water & Sewage; U.S. Govt. Publications; Manufacturers' Publications; Addresses of Engineering Societies; and an Index to Authors.

Truly an aid to any technical library, this booklet may be obtained by using a Reader Service Card, on which is entered the above key number and your name and address.

608
VENTURI CONTROLLER

Builders-Providence, Inc., has issued a bulletin on the **Builders Controller, Venturi Direct Acting Model.** This unit is fully described in the bulletin, which discusses precision control, loss of head, balancing valves, flexible design, and other features of the unit. A complete cutaway diagram shows how the controller works.

If you are interested in filter controllers, you will want a copy of this bulletin. To obtain one, use a Reader Service Card on which is entered the above key number and your name and address.

609
SWIM POOL PRESSURE FILTERS

%Proportioneers, Inc.%, Providence, R.I., has issued a bulletin on the **"Pur-O-Cel" Pressure Filters** for swimming pools.

This bulletin describes these "Pur-O-Cel" filters, the method of construction, their use, and advantages in filtering water for swimming pools.

A general description of the filter system, filter septa, piping and valves, the use of a diatomaceous earth body feeder and slurry tank are included.

The bulletin is complete in that it shows the different types of installations with single and multiple units.

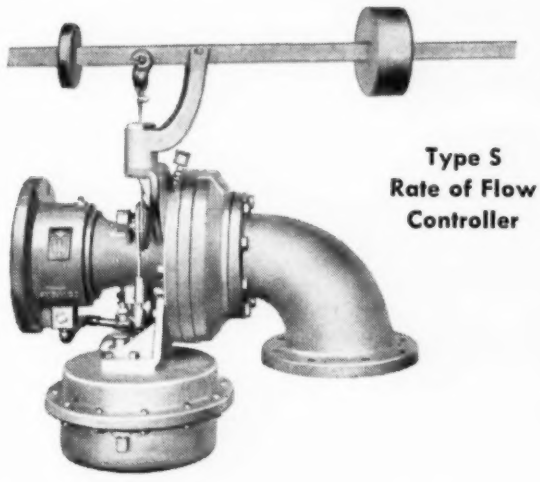
To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

610
MOTOR STARTERS

Allis-Chalmers, Milwaukee, Wis., has published a bulletin on **Alternating Current Across-the-Line Motor Starters.** Construction features and uses of manual and magnetic across-the-line starters, reversing starters, and push-button control stations are all described and illustrated.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

Everything's under control- WITH SIMPLEX



Type S
Rate of Flow
Controller

ACCURATELY CONTROLS RATE OF FLOW OVER LONG RANGES!

Of the most advanced, proven design, Simplex Type S controllers meet all requirements of modern filter plants! Look at these unmatched advantages:

- Compact design, low weight
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For bulletin with full information, write to the Simplex Valve & Meter Co., Dept. 6, 6743 Upland Street, Philadelphia 42, Pa.

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• Many of the Buffalo-made Water Meters installed by water works up to forty years ago are still giving daily service.

Meters installed in 1949 will give even better service because of the many refinements in today's American or Niagara meters.

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WATER METERS

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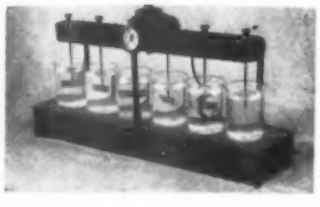

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LABORATORY MIXER

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.

BOND-O

A safe self-caulking, self-sealing compound for jointing water mains. Used with complete confidence. Machine-blended for absolute uniformity. All BOND-O contains a germicide to inhibit oxidation by sulfur bacteria.

Northrop
Northrop & Company, Inc.
SPRING VALLEY, N. Y.

Every Bond-o Joint is a Good Joint

611
ROTARY DISTRIBUTORS

Ralph B. Carter Co., Hackensack, N.J., has available a bulletin on **Rotary Distributors and Automatic Dosing Siphons.** This bulletin not only describes the distributors and dosing siphons but also describes a unique and improved type of leveling flange which is a part of the Carter Rotary Distributor. This leveling flange is a device permitting unit realignment without disassembly of any part of the distributor mechanism.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

612
CHLORINATION TOPICS

Wallace & Tiernan, Inc., Newark, N.J., has combined the two separate editions of **Chlorination Topics** into one, beginning with the April, 1949, issue. Formerly published in the Public Health and Industrial editions, henceforth there will be but one. The latest edition contains a number of interesting news stories including one about the disposal of atomic wastes and another about the water shortage at Ripley, New York, where fire hose was laid for more than 7000 feet to bring water from Lake Erie when the local surface supply was exhausted last summer.

Also included in this edition is a story about the chlorination plant at the Hyperion Sewage Plant in Los Angeles and a literature review divided into two sections, Sanitary and Industrial.

To obtain a copy of this publication on "Chlorination Topics," use a Reader Service Card, on which is entered the above key number and your name and address.

613
INDUSTRIAL WASTE DISPOSAL

The Bristol Co., Waterbury 91, Conn., has announced the publication of a bulletin entitled **"Industrial Waste Disposal".**

The bulletin describes the application of the company's automatic pH recording and controlling instruments and recording flowmeters to industrial waste disposal operations.

Photographs of the instruments and diagrams of typical waste disposal applications are included.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

614

ELECTROPHOTOMETER

Fisher Scientific Co., and Eimer & Amend of Pittsburgh, Pa., have issued a bulletin on **"The Fisher Electrophotometer."**

This bulletin describes the standard instrument for colorimetric analysis and shows the working parts of the apparatus and how it operates.

To obtain a copy of this new bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

615

ORIFICE DATA

Hagan Corp., Hagan Bldg., Pittsburgh, Penna., has available a very useful bulletin on **Capacity Data for Concentric Orifices & Flow Nozzles.**

This bulletin presents a convenient method for approximating the orifice or nozzle throat to pipe diameter ratios (Beta ratio) required for satisfactory fluid meter installations. The bulletin presents the formulas used, the conditions under which accuracy of calculation may be expected and examples of calculations. There is also a diagram constructed from the basic formulas, known as the M Factor diagram, the value of M depending on flow quantity and specific volume calculated from formulas given in a table in the bulletin. Other diagrams show the square root of specific volume of air and of water as well as superheated steam. A table of squares of internal pipe diameters is also included as is a graph of the relation of flow coefficient to the Beta ratio. This bulletin was developed especially for use with the Ring Balance Mechanical Flow Meters produced by the Hagan Corp., but the information in the bulletin will be of interest to any one having a flow measurement problem.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

616

FLOCCULATION

Walker Process Equipment, Inc., has issued a bulletin on **FS Intra-Zonal Flocculation.**

This four-page folder discusses flocculation and describes the advantages of this particular unit for producing flocculation.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

(Above) Typical small-size R-C Meter with inclined differential gauge, with top inlet, and outlet in bedplate.

(Right) Example of large-size, low-pressure R-C Meter, side inlet box and bottom outlet, with a P.V.T.T. Recorder.

Built-in characteristics of R-C Positive Displacement Meters insure unfailing, long-time accuracy:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture or impurities.
2. Accuracy does not depend on uncontrollable factors.
3. Accuracy is not subject to adjustment of meter or recorder by operators.
4. Accuracy is not affected by reasonable overloads.
5. Accuracy is permanent because measuring chambers are surrounded by precision-machined cast iron surfaces.

R-C Meters are built in 31 standard sizes, with capacities from 4,000 to 1,000,000 CFH. Indicating and recording instruments are available for all types. Send for details in Bulletin 40-B-14 or write us about your specific problem.

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OVER 80 years of manufacturing experience . . . designed for easy installation . . . long years of trouble-free service . . . interchangeable with those of other manufacturers . . . corporation stops can be installed with any standard tapping machine.

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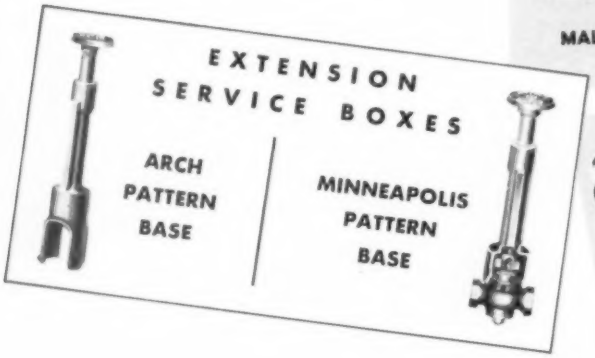
INVERTED PLUG CURB STOP

MALE ADAPTOR



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ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.

Engineers and Sales Agents

617

POROUS UNDERDRAIN SYSTEMS

The Carborundum Co., Refractories Div., Perth Amboy, N.J., has available a bulletin on the **"Aloxite" Brand Porous Underdrain Systems.**

These porous underdrain systems are designed for rapid water filters and softeners, and the bulletin describes the advantages of this type of underdrain, cost of installation, operation, its use with surface wash, design of the systems, use in pressure filters, and methods of anchoring the plates, as well as a discussion of technical properties on head loss, physical properties, and operation.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

618

GATE VALVE OPERATION

Payne Dean & Co., Madison, Conn., has issued its 1948 Edition of **Gate Valve Operation.** This 12-page bulletin shows gate valve operation by the Powerench, a portable unit; the Gatender, a small self-propelled truck, and the truck-mounted gate valve operator. The method of mounting the operator on trucks is detailed, showing how it can be done on any water works service truck. Two pages are devoted to the Gatender, its construction, and usefulness for other purposes. Two pages are also devoted to the small gate operator and utility power unit, the Powerench, which consists of a small gasoline engine, a mercury clutch, a flexible shaft and the operating head. The book concludes with a description and picture of the Dean Universal Gate Key.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

619

SCREENINGS GRINDER

Infilco, Inc., 325 W. 25th Place, Chicago 16, Ill., has a bulletin on the **Griductor,** a device for screening and cutting sewage particles in a straight channel flow.

The eight-page bulletin explains what the "Griductor" does and the advantages of an installation of this device for shredding and cutting sewage screenings. The device which is installed in a straight channel is thoroughly described in this bulletin and the operating parts of the unit are clearly shown in cut-away drawings. The bulletin also contains a

table of dimensions and a graph of recommended capacities for installation.

To obtain a copy of this bulletin use a Reader Service Card, on which is entered the above key number and your name and address.

620

SLUDGE COLLECTOR

Yeomans Bros. Co., 1433 Dayton St., Chicago 22, Ill., has available a bulletin on the **Yeomans Streamlined Sludge Collector.** This eight-page bulletin shows installations of these collectors for straightline tanks. Drawings of the collectors and how they are installed are shown, as is a drawing of the design details of a dual drive unit assembly.

To obtain a copy of this bulletin, use a Reader Service Card, on which is entered the above key number and your name and address.

621

TUBULAR CONVEYOR

Hapman Conveyors, Inc., 2405 W. McNichols St., Detroit 21, Mich., has issued a bulletin on the **Hapman Tubular "Cable-Veyor."**

These tubular conveyors are described in this 4-page bulletin which presents the many advantages of this type of handling material. They are available for handling dry chemicals in bulk at water and sewage plants and will handle any flowable material. They are sanitary, self-cleaning, and give positive material movement with high speed and capacity.

For the water and sewage field, Stuart Corp., 516 N. Charles St., Baltimore 1, Md., represents the Hapman Corporation.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

622

FLAT SPRAY NOZZLES

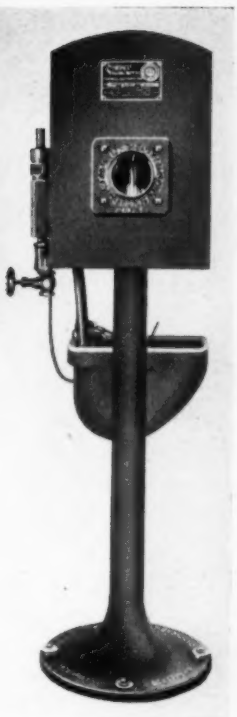
Chain Belt Co. of Milwaukee has reprinted and revised their bulletin describing **Rex Flat Spray Nozzles.**

This bulletin illustrates these nozzles in service where water or liquid chemicals are used in cleaning, cooling, washing, and descaling operations. The bulletin also gives their uses and tabular information concerning their discharge in gallons per minute, dimensions, etc.

To obtain a copy of the bulletin on flat spray nozzles, use a Reader Service Card on which is entered the above key number and your name and address.

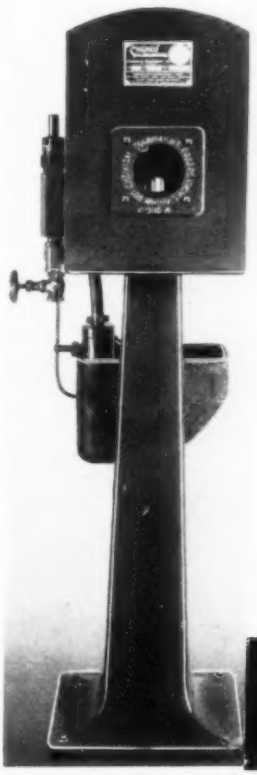
CHEMCO Type M-5
CHLORINATOR
CAPACITY RANGES
0-10 lbs. per 24 hours

Chemco
CHLORINATORS



Chemco Chlorinators are the result of nearly 25 years experience in water treatment and are used in 42 of the 48 states and foreign countries.. They have outstanding design features as shown below...

CHEMCO Type M-3
CHLORINATOR
CAPACITY RANGES
0-10, 0-15, 0-25
lbs. per 24 hours



CHEMCO Type M-1
CHLORINATOR
CAPACITY RANGES
0-10, 0-25, 0-50
0-100, 0-200, 0-300
lbs. per 24 hours

1 *CHEMCO Chlorinators are simple, sturdy and foolproof in design.*

2 *CHEMCO Chlorinators are all based on vacuum design*

3 *CHEMCO Chlorinators can be flooded with water without damage.*

4 *CHEMCO Chlorinators have no regulator plates, springs or diaphragms to eat out and cause expensive repair cost.*

5 *CHEMCO Chlorinators have no moving parts working in an atmosphere of wet chlorine gas.*

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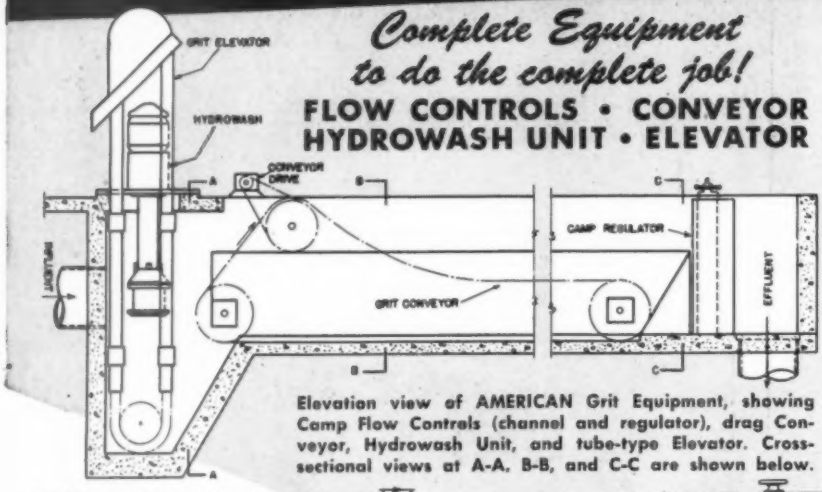
REMOVE GRIT
EASILY... THOROUGHLY... AT LOW COST!

Complete Equipment to do the complete job!

FLOW CONTROLS • CONVEYOR HYDROWASH UNIT • ELEVATOR



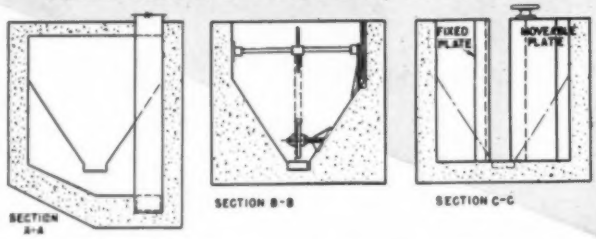
Elevation view of AMERICAN Grit Equipment, showing Camp Flow Controls (channel and regulator), drag Conveyor, Hydrowash Unit, and tube-type Elevator. Cross-sectional views at A-A, B-B, and C-C are shown below.

PROVIDES CONSTANT OPTIMUM VELOCITY

POSITIVE ADJUSTMENT FOR VARYING FLOWS

HYDRO-DYNAMIC WASHING

AUTOMATIC DRAINING AND REMOVAL



FLOW CONTROLS—exclusive Camp Control Section and Regulator maintain constant optimum velocity for effective grit settling, regardless of rate of flow through plant. Velocity can be easily and instantly adjusted to meet changing conditions.

CONVEYOR—single strand, continuous drag type carries grit from channel to hopper for washing and removal.

HYDROWASH UNIT—washes grit free of organic matter by producing a turbulent downflow recirculation of liquor in grit hopper.

ELEVATOR—totally enclosed, tube type, for slow and continuous removal of washed grit from the hopper. Grit drains as it is being elevated through the tube.

Write for Bulletin No. 249A

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623
CONCRETE IMPROVER

Hopper Products, Inc., 12 E. 41st St., New York 17, N.Y., has available a folder on **Portite.** This is a concrete improver unlike anything else on the market.

The bulletin discusses laboratory and field findings that may be of use in designing better concrete, cement plaster, and mortar. The uses and advantages of this material are completely described.

To obtain a copy of this folder, use a Reader Service Card on which is entered the above key number and your name and address.

624
FLOOR AND ROOF SLAB

The Flexicore Co., Inc., Dayton 1, Ohio, has issued a bulletin on **Flexicore Floor and Roof Slab,** for industrial, commercial, institutional, residential, and agricultural building.

This catalog should be of interest to designing engineers who are preparing plans for either water or sewage treatment plants. It is also of interest to any operating superintendents who are doing their own building. The catalog shows the use of these precast slabs for all types of building construction.

To obtain a copy of this catalog, use a Reader Service Card on which is entered the above key number and your name and address.

625
CHLORINATOR

Fischer & Porter Co., Hatboro, Pa., has issued a bulletin on the **Rato-Chlor Dry-Vacuum Chlorine Dispensing Units.**

This bulletin shows the Rato-Chlor system together with recording instruments, totalizers, diagrams of the equipment used, and the operating features of the Rato-Chlor chlorine dispenser. Also included are sections on ejectors and chlorine evaporators.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

626
FERRIC CHLORIDE BOOKLET

Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa., has issued a simplified manual on the properties, uses, and methods of handling ferric chloride.

This is a 12-page leaflet which gives the most important uses of ferric chloride in the precipitation of

sewage and sewage sludge conditioning, and in other uses.

The booklet contains information on Pennsalt's two commercial forms of the product, listing their characteristics and equipment recommended for their use. The booklet is entitled **Anhydrous Ferric Chloride.**

To obtain a copy of this booklet, use a Reader Service Card on which is entered the above key number and your name and address.

627

COIL SPRING FILTER

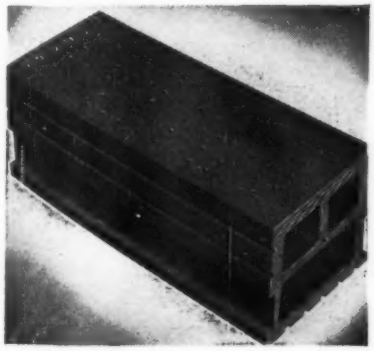
In a four-page bulletin, the Komline-Sanderson Engineering Corp., Ridgewood, N.J., describes their **Coil Spring Filter.**

This unique device is advertised as being unable to be clogged and as a permanent filter media for continuous operation. Among the advantages are constant output and minimized down-time. The bulletin explains this permanent type of filter media, discusses its application, and the piping which is needed. Diagrams show how the filters work.

To obtain the bulletin on this new unit, enter the above key number on a Reader Service Card together with your name and address and mail to this magazine.

Leopold

GLAZED FIRE CLAY TILE FILTER BOTTOM



• Permanent •Non-corrosive • Economical • Impervious to acid or alkali solutions • Practically non-absorbent • Equal distribution.

Complete water purification and sewage plant equipment.

Write today for complete information

F. B. LEOPOLD CO., INC.

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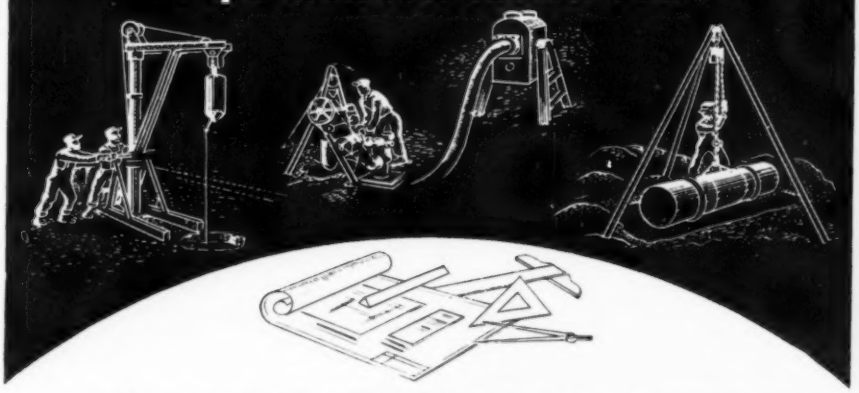
Some of the equipment necessary for a Complete Pipe Rehabilitation Job



. . . and some of the results obtained with this equipment—

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4.8 M.G.D.—INCREASE

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Before Cleaning "C" Value	62
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10,000 feet—24" Main

Before Cleaning "C" Value	81
After Cleaning "C" Value	122

35,000 feet—30" Main

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After Cleaning "C" Value	130

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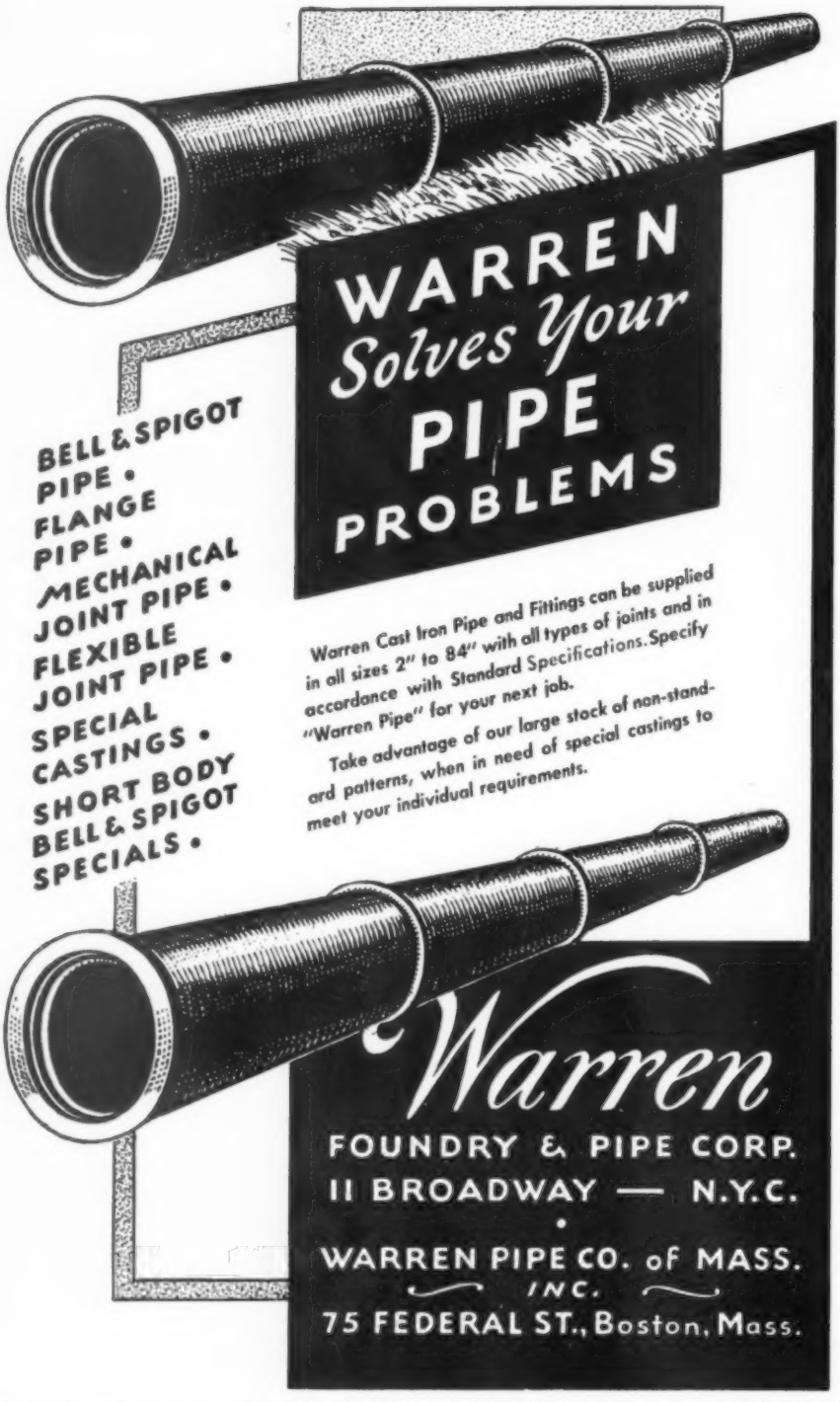
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628

V-BELT DRIVES

U. S. Rubber Co., Rockefeller Center, New York 20, N.Y., has published a 100-page manual on the design and use of both multiple and light duty V-belt drives.

The manual contains a comprehensive set of drive tables for multiple belts, complete sheave data, fractional horsepower drive layouts, and comparison tables.

To obtain a copy of this bulletin on V-belt drives, use a Reader Service Card on which is entered the above key number and your name and address.

629

CENTRIFUGAL PUMP

Peerless Pump Div. of Food Machinery and Chemical Corp., Los Angeles 31, Calif., has issued a bulletin on the **Peerless Type A Centrifugal Pump.**

This bulletin contains a complete description of the construction features of this type of pump, with blueprints and diagrams of the various parts of the different sizes and kinds of these units available.

These pumps have general characteristics of capacities up to 60,000 gpm., and heads up to 300 ft. They are driven by direct-connected belted drives, gasoline or natural gas engine, steam turbine, etc.

Among the types of pumps available are single stage, single suction; double suction, single stage; low head, single stage; double suction, bottom suction, etc.

Also shown are pictures of installations of the various types of pumps including those in water and sewage plants and in industrial plants.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

630

BANOX

Calgon, Inc., Hagan Bldg., Pittsburgh, Pa., has published a small folder with the title **"Stop This Rot."** This little item tells about "Banox," the material which protects fenders, bumpers, and underbodies of automobiles and commercial vehicles, which suffer such a toll of corrosion during the winter months, corrosion so often caused by the abrasive action of sand and the acidity of cinders and salt used on icy streets. The folder explains the use of "Banox" and tells how effective its use is to prevent corrosion of metal surfaces.

631
BACTERICIDES

Pennsylvania Salt Manufacturing Co., 1000 Widener Bldg., Philadelphia 7, Pa., has issued a new series of six leaflets on the following products: A soapless washing powder, B-K liquid chlorine bactericide, B-K chlorine-bearing powder, B-K can cleaning alkali, and B-K bottle Kompound and Perchloron.

To obtain copies of these leaflets, use a Reader Service Card on which is entered the above key number and your name and address.

632
PORTABLE AIR COMPRESSOR

P. K. Lindsay Co., 97 Tileston St., Everett 49, Mass., has issued a folder on the **Lindsay Portable Air Compressor.** This is a gasoline-driven unit with a 7 h.p. compressor mounted on a trailer type.

The compressor is used for pneumatic tools and will run three one-inch hammers. It is used for digging with an air hammer for breaking frozen ground, clay, hard pan, shale, rock drilling, and tamping back fill.

This equipment was recently on display at the Portland meeting of the Maine Water Utilities Association in February and attracted considerable attention.

To obtain a copy of this folder, use a Reader Service Card on which is entered the above key number and your name and address.

633
SOFTENER AND FILTER CONTROL VALVE

Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32, Penna., has issued a bulletin on the **Cochrane Hydromatic Single Control Valve.** This bulletin describes the new control valve designed to operate and control all of the functions of a zeolite softener or a pressure filter. In addition the bulletin discusses the operating features and applications of the valve and shows by cut-away drawings just how the valve functions to control the operations of a Zeolite softener and a pressure filter.

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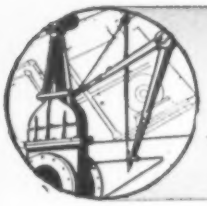

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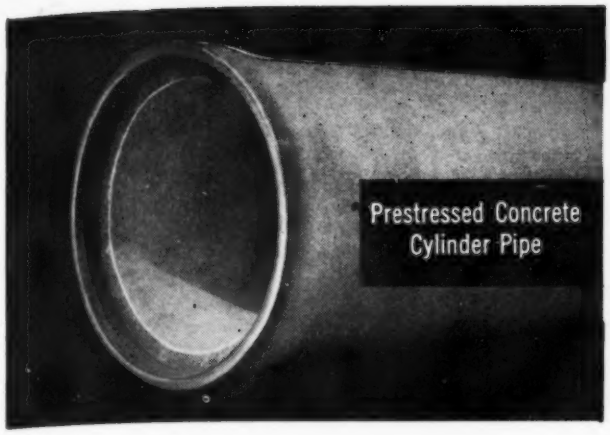

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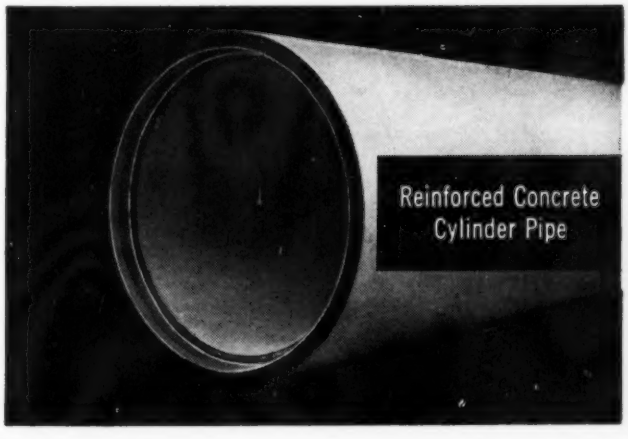

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BRANCH OFFICES:
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LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

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BREAK-POINT HELPS THIS WEST COAST WATER WORK

Typical of what Break-Point Chlorination can accomplish is this case history.

A 1½ mgd. west coast water works using an impounded supply was troubled by summertime odors so acute that settling basins had to be washed almost continuously, while in the winter, color ran as high as 500 ppm. To overcome these troubles, several treatment methods were tried —unsuccessfully. Then W&T Engineers, in cooperation with the plant staff, carefully analyzed the situation. At their suggestion, the Break-Point Process was employed, using W&T Chlorinators for pre-chlorination. With this treatment, according to a report by staff members, color troubles, together with complaints concerning iron and manganese stains, were eliminated; filter runs increased; and summer time odors cut almost to the vanishing point.

The W&T Residual Chlorine Recorder is especially valuable in securing the best possible results with the Break-Point Process.

In addition to such direct chlorination benefits, when you call on W&T you have the added assurance of W&T's 35 years of chlorination experience—a full line of chlorinators from which to choose—the backing of extensive research and development facilities—and finally, a top-notch, alert field organization at your call for prompt service and technical assistance.

For more details, ask your nearest W&T Representative—he'll be glad to help you.

WALLACE & TIERNAN COMPANY, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

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